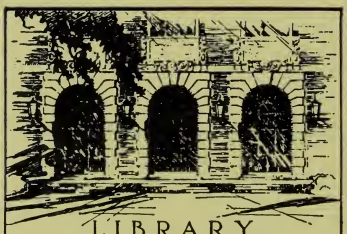

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UNIVERSITY OF ILLINOIS BULLETIN

Vol. 1 JUNE 15, 1904 No. 18

[Entered at Urbana, Illinois, as second-class matter]

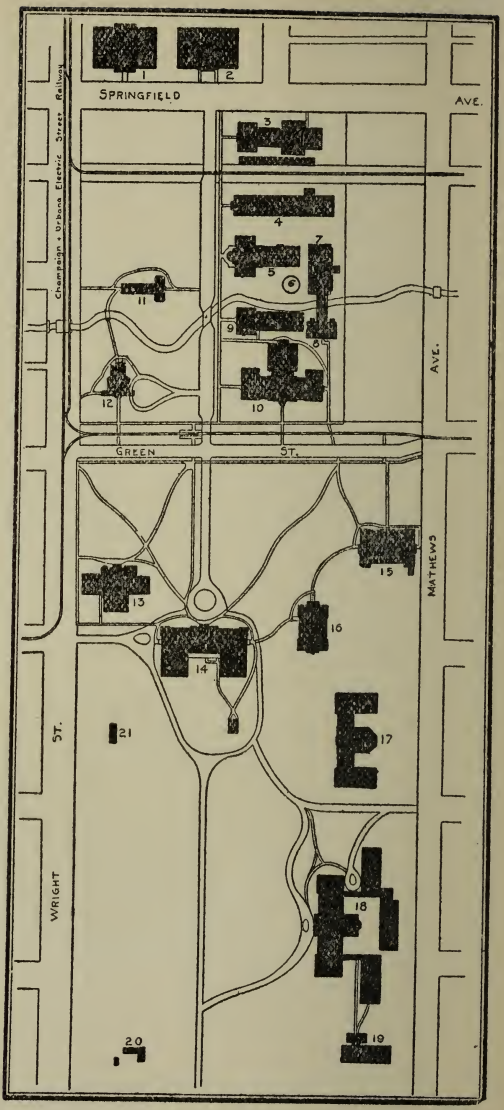
GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

PUBLISHED FORTNIGHTLY BY THE UNIVERSITY

1. Men's Gymnasium.
2. Armory.
3. Wood Shop.
4. Metal Shops.
5. Electrical and Mechanical Laboratory.
6. Reservoir.
7. Heating Plant.
8. Pumping Plant.
9. Laboratory of Applied Mechanics.
10. Engineering Hall.
11. Greenhouse.
12. President's House.
13. Library.
14. University Hall.
15. Natural History Hall.
16. College of Law.
17. Chemical Laboratory.
18. Agricultural Buildings.
19. Greenhouse.
20. Veterinary Building.
21. Insectary.



UNIVERSITY GROUNDS AND BUILDINGS

GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1904-1905

URBANA, ILLINOIS
PUBLISHED BY THE UNIVERSITY

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TABLE OF CONTENTS

Calendar 4
Board of Trustees 6
Officers of Administration 7
Heads of Departments 9
Location and History 11
Organization of the University 12
Buildings and Grounds 15
Laboratories and Collections 16
History of the Graduate School 24
Admission and Registration 25
Studies and Examinations 27
Degrees 29
Fellowships 31
Courses of Study 33
Subjects of the College of Literature and Arts . . 34
Subjects of the College of Science 50
Subjects of the College of Agriculture 68
Subjects of the College of Engineering 76
Societies and Clubs 86
Expenses 90

11/19/58
Barry

THE UNIVERSITY CALENDAR

1904-1905

1904	FIRST SEMESTER
Sept. 7, Wednesday.	Entrance Examinations begin.
Sept. 12, 13, Monday and Tuesday.	Registration Days.
Sept. 14, Wednesday.	Instruction begins.
Oct. 31, Monday.	Latest date for announcing Subjects of Theses.
Nov. 24, Thursday.	Thanksgiving Day.
Dec. 21, Wednesday.	Holiday Recess begins.
1905.	
Jan. 3, Tuesday.	Instruction resumed.
Jan. 27, Friday.	First Semester ends.
	SECOND SEMESTER
Jan. 30, Monday.	Instruction begins.
May 11, 12, Thursday and Friday.	University High School Conference.
May 12, Friday evening.	Interscholastic Oratorical Contest.
May 11, 12, 13, Thursday to Saturday.	Public School Art Exhibit.
May 13, Saturday.	Interscholastic Athletic Meet.
May 22, Monday.	Hazelton Prize Drill. Company Competitive Drill.
May 26, Friday.	Latest Day for Acceptance of Theses.
June 4, Sunday.	Baccalaureate Address.
June 5, Monday.	Class Day.
June 6, Tuesday.	Alumni Day.
June 7, Wednesday.	Thirty-fourth Annual Commencement.

FIRST SEMESTER

Sept. 13, Wednesday.	Entrance Examinations begin.
Sept. 18, 19, Monday and Tuesday.	Registration Days.
Sept. 20, Wednesday.	Instruction begins.
Nov. 6, Monday.	Latest date for Announcing Subjects of Theses.
Nov. 30, Thursday.	Thanksgiving Day.
Dec. 15, Friday.	Holiday Recess begins.
1906.	
Jan. 2, Tuesday.	Instruction resumed.
Jan. 26, Friday.	First Semester Ends.

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THE PRESIDENT OF THE STATE BOARD OF AGRICULTURE, "
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BUSINESS MANAGER: SAMUEL W. SHATTUCK, C.E. Office, Library Building. Office hours, 3 to 5 p. m.

REGISTRAR: WILLIAM L. PILLSBURY, A.M. Office, Library Building. Office hours, 2 to 5 p. m.

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*President's House, University Campus, U.**

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*U. stands for Urbana, C. for Champaign.

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HARRY SANDS GRINDLEY, Sc.D., Associate Professor of Chemistry. *918 West Green Street, U.*

LOCATION AND HISTORY

LOCATION

The University of Illinois is situated in Champaign County, in the eastern central part of the state, between the cities of Urbana and Champaign, and within the corporate limits of the former. It is one hundred and twenty-eight miles south of Chicago, at the junction of the Illinois Central, the Cleveland, Cincinnati, Chicago and St. Louis, and the Wabash railroads. The country around is a rich and prosperous agricultural region. The cities of Urbana and Champaign have, together, a population of about 17,000.

HISTORY

The University was incorporated February 28, 1867, under the name of the Illinois Industrial University, and was opened to students March 21, 1868. At first only men were received, but on March 9, 1870, women were also admitted. The institution is in part endowed by the national government, and is maintained by the State of Illinois. The present value of property is estimated at $2,600,000. In 1885 the state legislature changed the name to the University of Illinois. In the same year also, by act of the legislature, the *State Laboratory of Natural History* was transferred from the Illinois State Normal University. The *Agricultural Experiment Station*, founded upon an annual congressional donation, was established in 1887. The *Graduate School* dates from 1892. May 1, 1896, the Chicago College of Pharmacy, located at 465 State street, Chicago, became the *School of Pharmacy of the University of Illinois.* A *School of Law* organized in 1897 became the *College of Law* in

1900. The College of Physicians and Surgeons of Chicago, Corner Congress and Honore Streets, became, April 21, 1897, the *College of Medicine of the University of Illinois;* the instruction in music was reorganized and the *School of Music* was established, and the *State Library School* was opened in September of that year. The *School* (now *Colleye*) *of Dentistry*, Corner of Harrison and Honore Streets, Chicago, was opened October 3, 1901.

The corps of instruction for the year 1903-1904, not counting administrative officers, includes 101 professors, 42 associate professors, 41 assistant professors and 136 instructors and assistants. The total number of students for the same year is 3594, of whom 2876 are men and 718 women. 2552 are connected with the departments in Urbana, and 1042 in Chicago.

ORGANIZATION OF THE UNIVERSITY

For the purpose of more efficient administration, the University is divided into several colleges and schools. This division does not imply that the colleges and schools are educationally separate. They are interdependent, and together form a unit. In addition to the courses mentioned as given in each college and school, instruction in military science and physical training is provided. The organization is as follows:

I. The College of Literature and Arts.
II. The College of Engineering.
III. The College of Science.
IV. The College of Agriculture.
V. The Graduate School.
VI. The School of Library Science.
VII. The School of Music.
VIII. The College of Law.
IX. The College of Medicine.
X. The School of Pharmacy.
XI. The College of Dentistry.

THE COLLEGE OF LITERATURE AND ARTS

The College of Literature and Arts offers a wide range of subjects in philosophy and the arts, including:

1. The ancient classical languages.
2. English literature and language, including rhetoric.
3. The Romanic languages, including French, Italian and Spanish.
4. The Germanic languages, including German, Scandinavian and Danish.
5. The political and social sciences, including history, economics, sociology, anthropology, and science of government.
6. Courses of training for business.
7. Philosophical subjects, including philosophy, mathematics, psychology, education, and ethics.
8. Courses in library science, consisting of three years' college work, followed by the first year in the School of Library Science.

THE COLLEGE OF ENGINEERING

The College of Engineering offers courses—

1. In Architecture.
2. In Architectural Engineering.
3. In Civil Engineering.
4. In Electrical Engineering.
5. In Mechanical Engineering.
6. In Municipal and Sanitary Engineering.
7. In Railway Engineering.

THE COLLEGE OF SCIENCE

The College of Science offers courses in—

1. General Science.
2. Chemistry.
3. Education.
4. Household Science.
5. Library Science.
6. Mathematics.
7. Physics.
8. Studies Preliminary to Medicine.

COLLEGE OF AGRICULTURE

The College of Agriculture offers courses in—

1. Agronomy.
2. Animal Husbandry.
3. Dairy Husbandry.
4. Horticulture.
5. Household Science.
6. Veterinary Science.

THE GRADUATE SCHOOL

The Graduate School offers courses in twenty-seven distinct subjects, as follows: agronomy, animal husbandry, architecture, botany, chemistry, civil engineering, economics, education, electrical engineering, English language and literature, French, geology, German, Greek, history, horticulture, household science, Latin, mathematics, mechanical engineering, municipal and sanitary engineering, philosophy, physics, physiology, psychology, thremmatology, and zoology.

The courses of instruction under these subjects are hereafter described.

THE SCHOOL OF LIBRARY SCIENCE

The School of Library Science, or the State Library School, offers a course of study extending over five years, three of which are in either the College of Literature and Arts or the College of Science. The last two years are devoted to courses in library science in the Library School. The full course leads to the degree of bachelor of library science.

THE SCHOOL OF MUSIC

The School of Music offers courses in vocal and instrumental music, leading to the degree of bachelor of music.

THE COLLEGE OF LAW

The College of Law offers a course of study leading to the degree of bachelor of laws.

THE COLLEGE OF MEDICINE

The College of Medicine offers a course of study leading to the degree of doctor of medicine.

THE SCHOOL OF PHARMACY

The School of Pharmacy offers a course in all branches necessary to a complete scientific and practical knowledge of pharmacy, including pharmacy, chemistry, materia med ica, botany, physics, and physiology. The course leads to the degree of graduate in pharmacy.

THE COLLEGE OF DENTISTRY

The College of Dentistry offers a course leading to the degree of doctor of dental surgery.

BUILDINGS AND GROUNDS

The land occupied by the University embraces about 220 acres. The campus is roomy and presents a very attractive appearance. The main buildings, 20 in number, include the *Library Building* containing stack-room space for 150,000 books, reading rooms, seminary rooms, administrative offices and quarters for the Library School; *University Hall*, a large structure of four main floors containing the administrative offices and class rooms of the College of Literature and Arts and the rooms of the School of Music; the *Law Building* in which are the offices, lecture rooms, moot court room, library, etc., of the College of Law; *Natural History Hall* in which are housed the departments of botany, zoology, physiology, and geology and the apartments of the State Laboratory of Natural History; the *Astronomical Observatory*; the *Chemical Laboratory* of three stories with a large lecture room, a number of large and several small laboratory apartments, supply room, offices, etc.; the *Agricultural Building* of four independent structures

built around an open court providing rooms for the administrative offices of the College and of the Agricultural Experiment Station, and for the departments of agronomy, animal husbandry, dairy husbandry, horticulture, veterinary science and household science; the *Engineering Hall* of four stories devoted to the offices, class rooms, drawing rooms, laboratories, etc., of the departments of architecture, civil, electrical, mechanical and municipal engineering and of physics; the *Wood Shop*, for instruction and practice with wood working tools and machines; the *Metal Shops* for work with metal working tools and machines; the *Mechanical and Electrical Engineering Laboratory*; the *Laboratory of Applied Mechanics*; the *Central Heating Station*; the *Pumping Station* from which the University is abundantly supplied with water; the *Armory* having one grand hall 100 by 150 feet; the *Men's Gymnasium*,—a three-story structure providing all the facilities of a modern gymnasium; and the *President's House.* A *Woman's Building* is in course of construction. The buildings for the Colleges of Medicine and of Dentistry and for the School of Pharmacy are in Chicago, and furnish excellent quarters for these important organizations.

LABORATORIES AND COLLECTIONS

SCIENCE LABORATORIES

The *botanical*, *geological*, *physiological*, and *zoological laboratories* are in Natural History Hall.

The *chemical laboratory* occupies the building of the same name, already described.

The *physical laboratory* is in Engineering Hall. It is provided with piers, a constant temperature room, and other conveniences for measurement work.

The *psychological laboratory*, in University Hall, is well

provided with apparatus of many different kinds for use in experimental study, research, and instruction.

A *laboratory of economic geology*, for the investigation of clays, lime and cement-making materials, building stones, road metal, and all other mineral substances of economic value, has been equipped with the necessary appliances for such investigations.

ENGINEERING LABORATORIES

The *cement laboratory* of the department of civil engineering occupies rooms in Engineering Hall.

The *electrical engineering laboratory* occupies space on three floors of the Mechanical and Electrical Engineering Laboratory.

The *mechanical engineering laboratory* occupies the rear wing of the Mechanical and Electrical Engineering Laboratory.

The *hydraulic laboratory* and the *materials testing laboratory* occupy the Laboratory of Applied Mechanics.

SPECIAL LABORATORIES FOR RESEARCH

The *chemical laboratory of the Agricultural Experiment Station* and the *student laboratory* for the study of fertility of soils are situated on the third floor of the Agricultural Building, as are also the *bacteriological laboratory* and the *physical laboratory* for the examination of soils.

The *materials* and *hydraulic laboratories* occupy the new Laboratory of Applied Mechanics.

The laboratory rooms of the *State Laboratory of Natural History* are in Natural History Hall.

A *Biological Station*, equipped for field and experimental work in aquatic biology, is maintained on the Illinois River by the State Laboratory of Natural History. It has its separate staff, but is open to students of the University at

all times, on application, and during the summer months to special students not connected with the University.

A *laboratory for sanitary water analysis* has been equipped with all necessary appliances, and chemical investigation of the water supplies of the state is carried on.

COLLECTIONS

AGRICULTURAL

The various agricultural departments maintain collections illustrative of their work, prominent among which are those showing typical specimens of standard varieties of corn, wax models of fruit and vegetables, an extensive horticultural herbarium, specimens of many breeds of live stock, a large collection of farm machinery, and exhibits of negatives and samples showing progress of certain investigations, as with fruit and with corn.

BOTANICAL

The *herbarium* contains about 50,000 mounted specimens of plants. The flora of North America is fairly well represented, the collection of species of flowering plants indigenous to Illinois is particularly complete, and a considerable collection of foreign species has been made. The collections of fungi amount to 32,000 named specimens, and include a full set of those most injurious to other plants, causing rusts, smuts, moulds, etc. There are specimens of wood from 200 species of native trees and shrubs, which well illustrate the varieties of native wood.

Plaster casts represent fruits of many of the leading varieties, as well as interesting specimens of morphology, showing peculiarities of growth, effects of cross-cultivation, etc.

ENGINEERING

The following departments of the College of Engineer-

ing have made extensive and valuable collections, which are placed in rooms in Engineering Hall.

Architecture

A large number of specimens of stone, bricks, terra cotta, sanitary fixtures, casts of moldings and of ornament have been accumulated, together with some excellent specimens of industrial arts, models of structures, working drawings of important buildings, 4,588 lantern slides, 20,000 plates and photographs, an excellent working library, and a large classified collection of plates from architectural journals.

Civil Engineering

The civil engineering department has a large room containing samples of iron, steel, wood, brick, and stone; materials for roads and pavements; models of arches and trusses, one of the latter being full-sized details of an actual modern railroad bridge. The department also possesses a very large collection of photographs and blue-print working drawings of bridges, metal skeleton buildings, masonry structures, and standard railroad construction.

Electrical Engineering

The department has a collection of samples illustrating standard practice in the industrial applications of electricity. There is also a rapidly growing collection of lantern slides, photographs, blue-prints, drawings, pamphlets, and other engineering data.

Mechanical Engineering

This department has among other things a partial set of Reuleaux models, together with models of valve gears, sections of steam pumps, injectors, valves, skeleton steam and water gauges, standard packings, steam-pipe coverings, and drop forgings. There are also fine examples of castings, perforated metal, defective boiler plates, and

sets of drills, with numerous samples of oil, iron, and steel. A large number of working drawings from leading firms and from the United States Navy Department forms a valuable addition to the above collections.

GEOLOGICAL

Lithology is represented by type collections of rocks (9,000 specimens), arranged to illustrate Rosenbusch; from Voight and Hochgesang, L. Eger, and A. Kranz; a type collection from Ward; 1,000 thin sections of rocks and minerals; a large number of ornamental building stones; a stratigraphic collection to illustrate Illinois geology, and a collection of Illinois soils (104).

The *Mineralogical* collection is especially rich in rock-forming minerals, ores, and materials of economic value. It contains over 12,000 specimens carefully selected to meet the wants of the student, and 575 crystal models.

The *paleontological* collection (49,000 specimens) contains representative fossils from the entire geologic series, but is especially rich in paleozoic forms. It embraces the private collections of A. H. Worthen (including 742 type specimens); Tyler McWhorter; Mr. Hertzer; 200 thin sections of corals; the Ward collection of casts, and a considerable number of special collections representing the fauna and flora of particular groups.

LIBRARY ECONOMY

A collection of books and phamplets on library science, of library reports and catalogs, of mounted samples showing methods of administration in all departments, and of labor-saving devices and fittings has been made, and is arranged by the Dewey Decimal classification in the Library School seminary room.

PEDAGOGICAL

In the rooms of the department of education in University Hall is a considerable collection of illustrative material from the manual training departments of various schools; photographs of school buildings, drawings and construtive work by pupils in the public schools, and the nucleus of a representative collection of apparatus for the school laboratory.

ZOOLOGICAL

The *zoological* collections have been specially selected and prepared to illustrate the courses of study in natural history, and to present a synoptical view of the zoology of the state.

The mounted mammals comprise an unusually large and instructive collection of the ruminants of our country, including male and female moose, elk, bison, deer, antelope, etc., and also several quadrumana, large carnivora and fur-bearing animals, numerous rodents, good representative marsupials, cetaceans, edentates, and monotremes. Fifty-nine species of this class are represented by one hundred and one specimens and all the others, excepting the Sirenia, are represented by mounted skeletons. There is also a series of dissections in alcohol, illustrating the comparative anatomy of the group.

The collection of mounted birds includes representatives of all the orders and families of North America, together with a number of characteristic tropical, Bornean and New Zealand forms. The collection is practically complete for Illinois species. There is also a fine collection of the nests and eggs of Illinois birds. A series of several hundred unmounted skins is available for the practical study of species, and the internal anatomy is shown in alcoholic dissections, and in mounted skeletons of all the orders.

The cold-blooded vertebrates are represented by a series of mounted skins of the larger species, both terrestrial and marine; mounted skeletons of typical representatives of the principal groups; alcoholic specimens; both entire and dissected, and casts. The alcoholics include series of the reptiles, amphibians, and fishes, the latter comprising about 300 species. The dissections illustrate the internal anatomy of the principal groups. The casts represent about seventy five species, nearly all fishes.

The mollusca are illustrated by alcoholic specimens of all classes and orders, and dissections showing the internal anatomy of typical forms. There are several thousand shells belonging to 1,700 species. The collection of Illinois shells is fair but incomplete.

The collection of insects has been greatly extended and enriched by the Bolter Collection, donated to the University by the executors of the estate of the late Andreas Bolter, of Chicago, which now contains over 16,000 species, represented by about 120,000 specimens, named, labled, and systematically arranged.

The lower invertebrates are represented by several hundred dried specimens and alcoholics, and by a large series of the famous Blaschka glass models.

The embryology of vertebrates and invertebrates is illustrated by several sets of Ziegler wax models, and numerous series of slides, sections, and other preparations.

In addition to the above, the extensive collections of the State Laboratory of Natural History are available for illustrative purposes, as well as for original investigation by advanced students.

ART GALLERY

The University Art Gallery was the gift of citizens

of Champaign and Urbana. It occupies a room in the basement of the Library Building, and furnishes an excellent collection of models for students of art. In sculpture it embraces thirteen full-size casts of celebrated statues, forty statues of reduced size, and a large number of busts and bas-reliefs, making in all over 400 pieces. It includes also hundreds of large autotypes, photographs, and fine engravings, representing many of the great masterpieces of painting of nearly all the modern schools, and a gallery of historical portraits, mostly large French lithographs, copied from the great national portrait galleries of France.

Other collections of special value to art students embrace a large number of casts of ornament from the Alhambra and other Spanish buildings, presented by the Spanish government; a set of casts from Germany, illustrating German renaissance ornament; a series of art works from the Columbian Exposition; large numbers of miscellaneous casts, models, prints, and drawings, such as are usually found in the best art schools, and a model in plaster and a complete set of drawings of a competitive design by Henry Lord Gay for a monument to be erected in Rome, commemorative of Victor Emmanuel, first king of Italy.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, and that of the College of Law are all at the University in Urbana. The libraries of the Colleges of Medicine and Dentistry and of the School of Pharmacy are in Chicago.

The general University library contains 63,724 volumes and 14,512 pamphlets. The reading room contains 755 periodicals. The library of the State Laboratory of Natural History contains 5,350 volumes and 15,850 pamph-

lets. The Library of the College of Law contains the Federal and State Reports, the leading text-books, and a line of leading periodicals. The department of education has made a special collection of about 1,500 books and 5,000 pamphlets, which are kept in the rooms of the department in University Hall. This collection contains a very good assortment of modern text-books, and copies of the courses of study of nearly all the large city school systems.

The Quine Library of the College of Medicine practically contains every book of reference required by medical students and all of the important medical periodicals.

The general library at the University is open daily, except Sunday, from 8 a. m. until 5 p. m. and from 6:30 p. m. until 9 p. m. on Mondays, Tuesdays, Wednesdays, and Thursdays. The reading rooms are open from 8 a. m. until 9 p. m. on Mondays, Tuesdays, Wednesdays, and Thursdays, and until 5 p. m. Fridays and Saturdays.

The Public Library of the City of Champaign contains the valuable library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical Society. The collection is accessible to University students.

THE GRADUATE SCHOOL

Thomas J. Burrill, Ph.D., LL.D., Dean.

HISTORY

The Graduate School was established in 1892, for the purpose of offering facilities for advanced study and research to graduates in a more systematic way than had hitherto been done in the University. In 1894 the School was placed in the general charge of the newly organized Council of Administration and the office of Dean was established. To the Dean was assigned the executive or administrative duties required. Graduate instruction had been given in certain departments of the University, and second, or master's degrees had been annually conferred during several years before the establishment of the Graduate School, but no conditions had been previously formulated upon which the doctor's degree (Doctor of Philosophy) would be given. The first publication of the requirements for this degree appeared in the Catalog for the year 1893-4 and the conditions then announced have since remained in force. The degree however, was not conferred until 1903, when two candidates successfully passed the prescribed requirements.

In order further to promote graduate study the provision was made when the School was established that its members should pay no fees of any kind and four fellowships were created each with a stipend of $400. Later, two more fellowships of the same value were added in the same way by the trustees. In 1896 these were changed to eight fellowships of $300 each. In 1904 the payment by graduates of the same fees required of undergraduates was ordered, except that fellows continue excused from such payments.

ADMISSION AND REGISTRATION

Graduates of the University of Illinois, and of other colleges and universities of approved standing, may be admitted to membership in the Graduate School upon presentation of their credentials. Other persons suitably qualified may gain admission by special vote of the Council of Administration upon such conditions as may be imposed in each case. To gain admission to particular graduate courses or departments the special preparation for this must be found sufficient, and an advanced degree for which candidacy is sought must be in line with the bachelor degree received. Candidates for admission may secure application blanks from the Dean or from the Registrar of the University, and these, properly filled out, should be filed, together with such documentary matter as may be presented, showing qualifications for membership in the School, with the former officer. This should be done not later than the time set for registration in September. Admission may be granted at other times, but the time limit required for degrees counts from the date of the certificate of membership.

With the exceptions named below, all members of the Graduate School are required to be in regular attendance at the University, and to do all the work for which they are registered in the departments to which such work belongs. In case of absence on leave, or when absence is necessary to carry on investigations included in approved courses of study, the requirement of continuous residence may be modified by the Council of Administration.

Graduates of this University may be admitted to non-resident membership in the Graduate School, as candidates for second or masters' degrees. In this case correspondence should first be addressed to the head of the department in charge of the major subject desired. All

members of the School who have completed the residence required for advance degrees may register as non-residents while completing the work required for such degrees.

Members of the Graduate School register with the Dean during the registration days, at the beginning of the collegiate year.

Those only are enrolled as members of the Graduate School who enter upon or pursue approved graduate work as explained under "Studies and Examinations" below. Resident graduates who are candidates for bachelor degrees are not included, neither are those who, not working for any degree, have registered without a major subject approved as graduate work.

STUDIES AND EXAMINATIONS

As far as can be indicated by a statement of time, full work for a graduate student consists in the use of forty-five hours a week in the lecture rooms, laboratories, etc., and in private study, equal to 30 *semester hours*' credit, exclusive of the preparation of a thesis. A semester hour is the credit given for one study on which the student is supposed to spend 3 hours of time each day 5 days a week for 18 weeks. Assignments of work are made upon this basis; but great variations naturally result from the subject-matter in hand, and from the abilities of individuals.

Each student must select one principal line of study, and upon this major subject at least one-half, 15 "hours," and in the subjects of the College of Engineering at least two-thirds, 20 "hours", of his work must be done; and any greater proportion of his time, up to the whole of it, may thus be devoted if proper approval is had. When work upon the selected major subject is not arranged to require all of the student's attention, he must choose one or two minor subjects, as may be necessary to complete a full course of study, 30 "hours". Usually, at least one

minor subject should be taken. Not more than two may be taken at the same time.

The major study must be approved as graduate work for this University, preceded by an amount of undergraduate preparation specified in connection with the courses of study or determined by the officers in charge. The minor subjects may, under approval, be chosen from the offerings to graduates, or from undergraduate courses of advanced grade, except that all work must be selected from graduate offerings in the subjects of the College of Engineering. In these the major line of study must be either a single subject or a combination of related subjects. But all candidates for advanced degrees must direct their selections toward some well-defined end, determined for the most part by the character and purpose of the major study.

All courses of study leading to degrees in the Graduate School are subject to approval, first, by the head of the department of the University in which the major subject for each student belongs; second, by the Dean of the College including such department; and, third, by the Dean of the Graduate School. The signatures of the heads of departments in which chosen minor subjects belong must also be obtained before the list reaches the Dean of the Graduate School. The lists of studies, as finally approved, are deposited with the Registrar of the University. No changes may subsequently be made except under the same line of approvals, but extension of time may be arranged with the professors concerned and with the Dean of the Graduate School.

Examinations are required in all subjects, and reports upon these are made to the Registrar of the University. Graduate students in undergraduate classes are examined with these classes.

The head of the department in which the student does his major work is charged with the direction and supervis-

ion of such major work, and, in a general way, with the supervision of the student's entire course of study. He fixes the time and method of all examinations not otherwise provided for, sees that they are properly conducted, and reports results to the Registrar. It is his duty also to keep the Dean of the Graduate School informed concerning all matters affecting the interests of the student, and of the School in connection therewith.

DEGREES

No degrees are given for study *in absentia*, except that graduates of this University, who become members of the Graduate School and reside elsewhere, may receive a master's degree upon the completion of their courses of study within not less than three years of the date of registration. Advanced degrees are conferred by the Trustees of the University only upon recommendation of the Senate, based upon information furnished by the Council of Administration.

Second Degrees

The second degrees conferred by this University are as follows:

Master of Arts, after Bachelor of Arts.

Master of Science, after Bachelor of Science, in courses in the College of Agriculture.

Master of Architecture, after Bachelor of Science, in courses of Architecture and Architectural Engineering.

Civil Engineer, after Bachelor of Science, in the course in Civil Engineering.

Electrical Engineer, after Bachelor of Science, in the course in Electrical Engineering.

Mechanical Engineer, after Bachelor of Science, in the course in Mechanical Engineering.

Pharmaceutical Chemist, after Graduate in Pharmacy.

All candidates for second degrees are required to regis-

ter in the Graduate School, to conform to the conditions outlined under "Admission and Registration," and "Studies and Examinations" (pp. 26 and 27); to pursue an approved course of study for one academic year in residence, or, in the case of graduates of this University, for three years *in absentia*; and to pass satisfactory examinations upon all the studies of the approved course.

Each candidate for a second degree must present an acceptable thesis in the line of his major subject of study. The subject of this thesis must be announced to the Dean of the Graduate School not later than the first Monday in November of the academic year in which the course is to be completed. The completed thesis, upon regulation paper, must be presented, with the certified approval of the professor in charge, to the Council of Administration not later than June 1st.

The period of required study begins from the date of registration in the Graduate School.

Doctor's Degree

The Degree of Doctor of Philosophy may be conferred upon any member of the Graduate School of not less than three years' standing who shall have reached high attainments in scholarship, including a sufficient knowledge of the French and German languages to serve the purposes of research in his principal specialty, who shall have shown marked ability in some line of literary or scientific investigation, and shall have presented a thesis giving clear indications of such scholarship and of such power of research. At least the first two, or the last one, of the three years of study must be in residence at the University, and the entire course of study must be in accordance with the regulations of the Graduate School.

The time and study required for a master's degree may be included in the three years required, but approval of a

course of study for a doctor's degree must be upon the condition that the candidate is prepared through his baccalaureate work, or otherwise, to enter at once upon advanced studies in the line of his major subject, and that work on his major subject be continued through the three years.

The final examination of a candidate for the doctor's degree is conducted by a committee consisting of the head of the department under which the major subject has been pursued, as chairman, and of not less than two additional members of the Senate of the University, appointed for the purpose by the Council of Administration. This examination covers the subjects of the course approved for the degree, but is especially searching upon that on which the major work has been done.

Each candidate for a doctor's degree must announce to the Dean of the Graduate School a thesis subject not later than the first Monday in November of the academic year at the close of which the award of the degree is expected. A fair copy of the thesis must be submitted, with a certified approval of the committee on examinations, to the Council of Administration not later than the first day of June. If the thesis is approved by the Council the candidate must have it printed and must deposit not less than one hundred copies with the librarian of the University.

FELLOWSHIPS

The Trustees of the University have established a number of fellowships, each with a stipend of three hundred dollars, payable in ten monthly installments.

The rules governing appointments to these fellowships are as follows:

1. The purpose of these fellowships shall be to promote advanced scholarship and original research in the University.

2. The fellowships shall be open to graduates of this and similar institutions. Those who are to complete an under

gradute course previous to the academic year for which appointments are made shall be eligible, with others, as candidates.

3. Nominations to fellowships, accompanied by assignments to special departments of the University, shall be made by the Council of Administration to the Trustees of the University, upon applications received by the President of the University each year not later than the first day of February. These nominations shall be made at a meeting of the Council called for that purpose within the month of February. The appointments by the Trustees are made at their regular meeting in March, and shall take effect the first day of the following September. Vacancies may be filled by similar nominations and appointments at other times.

4. Nominations to fellowships shall be made upon the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Consideration shall also be given to the probable value or usefulness of the services of the candidate as an assistant in instruction, but this shall not be deemed the primary object of the appointment. Other things being equal, preference is given to those graduates of this University who have pursued a specialized or group course.*

5. Candidates must present, with their applications, full information concerning themselves and their qualifications for advanced study and research work, including any written or printed essays or results of investigation, and must name the subject in which they wish to do their major work.

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*All members of the Colleges of Engineering and Agriculture, of the chemical and mathematical groups in the College of Science, of the College of Law, and of the Schools of Library Science and Music, are considered as pursuing specialized courses.

6. Fellowships are good for one year, but appointments may be renewed to the same person. An appointment as *honorary fellow*, without stipend, may be made as specified for paid fellowships in the case of anyone who has held a regular fellowship and has shown distinguished merit in his work.

7. Fellows shall be constituted members of the Graduate School, shall have all of the privileges and bear all of the responsibilities of such membership. Each regular fellow may be called upon to render service in instruction throughout the year in the department in which his major subject lies, equal to one hour daily of class instruction or to two hours daily of laboratory supervision. This service will receive such credit as the Council of Administration may determine in each case. Blank forms for application may be obtained by addressing the Registrar, or the Dean of the Graduate School.

GENERAL DESCRIPTION OF COURSES

Following the description of each course of instruction will be found the necessary requirements, if any, for admission to that particular course.

Credit is reckoned in semester "hours," or simply "hours." An "hour" is one class period a week for one semester, each class period pre-supposing two hours' preparation by the student, or it is the equivalent in laboratory, shop or drawing room.

The semester, the days, and the class period or periods during which each course is given, and the number of "hours" per semester for which the course counts, are shown after each course, as follows: The semester is indicated by the Roman numerals I., II.; the days by the initial letters of the days of the week; the class period or periods (of which there are nine each day, numbered consecutively from one to nine), by Arabic figures; and the "hours" or amount of credit, by Arabic figures in parenthesis.

SUBJECTS OF THE COLLEGE OF LITERATURE AND ARTS

ECONOMICS

(Including Commerce and Industry).

The work of the department of economics is expanded in the direction both of societal economics and industrial economics. A graduate student may pursue work in either line. No student will be permitted to elect economics as a major unless he has had a thorough course in the principles. Students who are not considered sufficiently well grounded will be required to take an elementary course in conjunction with, or preparatory to, their other work, but it cannot be counted towards an advance degree.

The department is thoroughly equipped both in library and in staff for the training of students in economic research in social and industrial lines. The Library contains complete sets of all important economic serials, in English, French, and German, is well equipped in practically all important lines of economic research, and has abundant material in several.

The opportunities for work in statistics, theoretical and practical, are unusually good. The University possesses a number of calculating machines of various kinds which are accessible to advanced students in their research work.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

3. MONEY AND BANKING.—The history and theory of money and banking, and the monetary history of the United States. II.; M., W., F.; 4; (3). Assistant Professor WESTON.

Required: Economics 1, or 2 and 7.

4. FINANCIAL HISTORY OF THE UNITED STATES. — A brief survey of the fiscal systems of the American colonies followed by a study of national finances from the beginning of the American

Revolution down to the present time. I.; M., W., F.; 2; (3). Assistant Professor HAMMOND.

Required: Economics 1.

5. PUBLIC FINANCE.—A study of the principles which should be followed in making public expenditures and in securing public revenues. II.; Tu., Th.; 4; (2). Assistant Professor HAMMOND.

Required: Economics 1.

6. TAXATION.—An investigation into the methods of taxation in the various American Commonwealths. II.; M., W., F.; 2; (3). Assistant Professor HAMMOND.

Required: Economics 5.

8. THE MONEY MARKET.— An advanced course dealing with rates of exchange, functions of bill broker and banker, causes of fluctuations in rates of discount, the concentration of financial dealings at such centers as New York and London, international payments and the determination of rates of foreign exchange. II.; Tu., Th.; 3; (2). Professor KINLEY.

Required: Economics 3 and 9.

9. BANKING.—A course in the study of practical banking, with special reference to the United States, England, Germany, France and the Orient. I.; Tu., Th.; 7; (2). Assistant Professor WESTON.

Required: Economics 3.

10. CORPORATION MANAGEMENT AND FINANCE.—The growth of corporations; their organization and securities, position and relations of stockholders and directors, analysis of reports, stock speculation, relation of industrial corporations to international competition, receiverships and reorganizations, social and political effects. I.; M., W., F.; 2; (3). Professor ROBINSON.

Required: Economics 1, or 2 and 7 or 22.

11. INDUSTRIAL CONSOLIDATIONS. — The development of industrial consolidations, their causes and forms; the promotion, financiering, incorporation and capitalization of corporate consolidations; monopoly prices and monopoly methods; the ability of trusts to affect prices, wages, interest and profits; and the proposed plans for controlling trusts, such as publicity, taxation of profits, and public ownership. II.; M., W., F.; 2; (3). Professor ROBINSON.

Required: Economics 10.

12. THE LABOR PROBLEM. — The labor movement and its

social significance. The progress of the laboring classes, strikes, arbitration, labor organizations, and similar topics, which are studied, show the general character of the course. I.; W., F.; 4; (3). Professor KINLEY.

Required: Economics 1. [Not given in 1904–05.]

13. RAILWAY MANAGEMENT. — This course considers from the administrative standpoint railways as factors in the social and industrial development of the United States and treats of the following topics:—(1) Historical: conditions of commerce and industry previous to the advent of the railways; primitive methods of transportation, etc. (2) Geographical: the economic location of railways, etc. (3) Organization; charter and franchises; capital stock; directors and stockholders; departments; the distribution of authority and responsibility; (4) Traffic management; (5) Financial: basis of capitalization; use of stocks and bonds; stock watering; distribution of earnings; reports and their interpretation, etc.; (6) Legal: rights and duties of railways; their status under the common and statute law; relation to leased lines; to employes; to patrons; taxation; public control through commissions. I.; M., W., F.; 4; (3). Professor ROBINSON.

Required: Economics 1, or 2 and either 7, 16 or 22. From junior and senior engineers economics 2, only, will be required.

14. RAILWAY SYSTEMS. — This course is a continuation of course 13. II.; M., W., F.; 4; (3). Professor ROBINSON.

Required: Economics 13.

17. SOCIOLOGY. — This course deals with the principles underlying social organization, and with the nature and development of social institutions. Special attention is given to the study of the family, the state and to race assimilation in the United States. The latter part of the course treats practical problems of charity and crime. II., M., W., F.; 1; (3). Assistant Professor HAMMOND.

Required: At least 28 hours of University credit.

18. ECONOMIC SEMINARY. — For investigation and for the study of current economic literature. I., II.; *arrange time.* Professors KINLEY, FISK, ROBINSON, HAMMOND, WESTON.

20. HISTORY OF ECONOMIC THOUGHT. — The history of the development of economic theory since the sixteenth century. I., II.; 7; (2). Professor KINLEY.

Required: 10 hours in economics.

21. Socialism and Social Reform.—II.; M., W., F.; 7; (3). Assistant Professor Weston.

Required: Economics 1, or 2 and 7.

23. Statistics. — A course in descriptive statistics. The course may be taken by itself, but is better taken with the first half of course 24. II.; F.; 7; (1). Assistant Professor Hammond.

Required: Economics 1 or 2.

24. Statistics. — Students of economics should take this course and 23 together. Those who do not wish the mathematical theory of probability may drop out of the class when that part of the subject is reached. For them the mathematical requirement for entrance is not enforced, and courses 23 and 24 count for four hours' credit. All who take the course must take both parts of it, as described under mathematics 26, which see.

Required: Economics I, or 2 and 7.

27. History of Commerce.—A general survey of commerce from ancient times, with special stress on the growth of commerce since the discovery of America. I.; M., W., F.; 3; (3). Professor Fisk.

Required: Economics 1, 7 and 26.

28. Domestic Commerce and Commercial Politics. — A comparative study of the various forms of commercial organization, such as general wholesale and retail trade, department, co-operative, and company stores, peddling, huckstering, and hawking, booths, auctions, commercial agents, including commercial travelers, and the coupon system. I.; M., W., F.; 3; (3). Professor Fisk.

Required: Economics 1, 7 and 26. [Not given in 1904–05.]

29. Foreign Commerce and Commercial Politics. — Continuation of course 28. A study of the various commercial systems (mercantile, free trade, and protective); kinds of tariffs; commercial treaties, reciprocity; commercial statistics and balances; institutions for furthering export trade (commercial museums and bureaus of information, sample houses, consular reports, etc.) II.; M., W., F.; 3; (3). Professor Fisk.

Required: Economics 1, 7 and 26. [Not given in 1904–5.]

30. History of the Commercial Policy of the United States.—An historical study of all those measures, such as tariff legislation, commercial treaties, navigation laws, bounties, sub-

sidies, consular matters, etc., which have an important bearing on the commercial side of the foreign relations of the United States. I., II.; M., W., 3; (2). Professor Fisk.

Required; Economics 1, 7, or 22 and 26.

31. History of the Commercial Relations of the United States. I., II.; M., W.; 4; (2). Professor Fisk.

Required: Economics 30.

32. Domestic and Foreign Markets of the United States.—One hour a week is devoted to a study of the distribution and domestic marketing of American products, especially farm products, while the second hour is given to a study of foreign markets for American exports. I., II.; W., F.; 4; (2). Professor Fisk.

Required: Economics 28, 29; or 27, 30.

33. Economics of Insurance. — The historical development of insurance, and an extended discussion of its economic aspects. The various forms of insurance—fire, accident, employment and life,—from the standpoint of internal organization and from that of social service. Rates, policies, investments, corporate management, accounting, public supervision, and insurance law. I.; *arrange time*; (2). Professor Robinson.

Required: Economics 10, 24.

34. Corporation Accounting.—The general principles of accounting and auditing in modern business. The report of railway, banking and industrial corporations are analyzed. The work is supplemented with a series of lectures by practical accountants. II.; Tu., Th.; 3; (2). Professor Robinson.

Required: Economics 10.

35. Consular and Diplomatic Service.—A comparative study of the consular service of the important countries, and of the diplomatic service so far as it affects foreign commerce. Special attention is given to the foreign service of the United States. I., II.; F.; 4; (1). Professor Fisk.

Required: Economics 30 and 31.

COURSES FOR GRADUATES

101. Recent Economic Theory.—For the year 1904–05. Theories of Wages and Profits is the subject of study. I., II.; *arrange time.* Professor Kinley.

102. Historical and Comparative Finance.—This course

is devoted to original investigation by the student and to reports and discussion in class, supplemented with lectures by the instructor. The work is conducted each year along the following lines. (1) A comparison of financial theories concerning public expenditures, the principles of justice in taxation, the incidence of taxes and the relation of taxation to social reform; (2) a comparison to the financial system of the United States with those of foreign countries; (3) a comparison of the taxing systems of the American commonwealths. For 1904–05 the last named subject has been selected. I., II.; *arrange time*; (2). Assistant Professor HAMMOND.

103. SEMINARY IN RAILWAY ADMINISTRATION.—Advanced students in this subject make a detailed study of one of the branches of railway administration. I., II.; *arrange time*; (2) Professor ROBINSON.

104. SEMINARY IN COMMERCE.—A study of present international commercial relations, with special reference to the trade conditions of the United States and the extension of her trade to foreign markets. I., II.; *arrange time*; (2). Professor FISK.

EDUCATION

Under the direction of this department are offered the pedagogical and the psychological courses included within the University curriculum. In both of these fields of study the department is well equipped for graduate instruction. The University Library, besides containing the files of nearly all the important serial publications in each, is well provided with the general and technical works which are essential to advanced study. Besides this, the department possesses a pedagogical library of upwards of 1,000 volumes and 5,000 reports, courses of study, etc., covering the general field of education which provides an invaluable field for the investigation of problems of school organization and administration. For work in psychology there is a laboratory, adequate for present needs, consisting of three rooms (beside a dark room) fully equipped with apparatus both for elementary instruction and for

the prosecution of research within the field of psychology. Although the department has no mechanician of its own, it has a well furnished work-shop in which the more simple pieces of apparatus for special investigation may be constructed and through arrangements with the shops of the College of Engineering the more elaborate ones are built.

Matriculants for major work either in pedagogical or psychological courses are supposed to have had at least one year's previous study in them.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

A. Pedagogical.

4. CONTEMPORARY EDUCATIONAL CONDITIONS AND MOVEMENTS IN THE UNITED STATES. I ; (2). Professor DEXTER.

5. A COMPARATIVE STUDY OF THE SECONDARY SCHOOL SYSTEMS OF FRANCE, GERMANY, ENGLAND, AND AMERICA. II; (2) Professor DEXTER.

6. HIGH SCHOOL ORGANIZATION AND MANAGEMENT. II.; (3)

7. SPECIAL METHODS IN SCIENCE AND MATHEMATICS. I., (2)

8. SPECIAL METHODS IN LANGUAGE AND HISTORY. I.; (2) Assistant Professor COLVIN.

9. EDUCATIONAL PSYCHOLOGY. II.; (2). Professor DEXTER.

10. SEMINAR, COVERING GENERAL PROBLEMS IN SCHOOL MANAGEMENT AND SUPERVISION. I., II.; (1). Professor DEXTER.

B. Psychological.

3 AND 4. EXPERIMENTAL PSYCHOLOGY.—A full laboratory course for the year. I., II.; (5). Professor DEXTER and Assistant Professor COLVIN.

5. GENETIC PSYCHOLOGY. II.; (2). Assistant Professor COLVIN.

6. COMPARATIVE PSYCHOLOGY. I.; (2). Assistant Professor COLVIN.

7. SEMINAR. I., II.; (1); Assistant Professor COLVIN.

8. THE PSYCHOLOGY OF THE EMOTIONS AND THE WILL. II,; (2). Assistant Professor COLVIN.

No courses strictly for graduate students are announced by the department, but arrangements are made with such students individually and such courses arranged as meet the particular needs. University credit varying in amount from one to five semester hours is given for this work.

ENGLISH LANGUAGE AND LITERATURE

The library contains all the principal journals devoted to English philology and many society transactions and other special publications together with complete sets of most of the standard English periodicals of the nineteenth century. A portion of the department library fund is reserved for buying special material for advanced students.

At least three years of college work in English is required for major work in this subject. Students who have not had one year of Old English (Anglo Saxon) must elect ENGLISH 8.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

5. SHAKESPEARE AND THE HISTORY OF THE DRAMA. I., II.; (3). Professor DODGE.

6. ENGLISH CRITICISM IN THE NINETEENTH CENTURY. I., II.; (2). Mr. PAUL.

7. ENGLISH FICTION IN THE EIGHTEENTH AND NINETEENTH CENTURIES. I., II.; (2). Associate Professor JAYNE.

8. OLD ENGLISH (ANGLO SAXON) PROSE. I., II.; (3). Professor DODGE.

15. METHODS OF TEACHING ENGLISH LITERATURE. I., II.; (1). Professor DODGE, Associate Professor JAYNE, Assistant Professor BALDWIN, Mr. PAUL.

19. THE LITERARY STUDY OF THE BIBLE. 1., II.; (3). Assistant Professor BALDWIN.

24. BROWNING.—Rapid critical reading of the poems. 1.; (3). Miss KYLE.

25. CHAUCER.—Critical reading of the principal poems. I.; (2). Professor DODGE.

26. ENGLISH BALLADS. II.; (2). Professor DODGE.

COURSES FOR GRADUATES

101. Research Course in Sixteenth Century Literature.—Professor Dodge and Assistant Professor Baldwin.

102. Research Course in Eighteenth Century Writers.—Professor Dodge and Associate Professor Jayne.

103. Research Course in Nineteenth Century Writers.—Associate Professor Jayne and Mr. Paul.

GERMAN

Courses in German primarily for graduates include courses in Old and Middle High German and a seminary for training independent literary investigation. These are supplemented by the more advanced of those courses which are primarily for undergraduates.

The Library is well equipped with works in German literature, especially of the classical and modern periods. It contains also complete files of the most important periodicals.

Graduate students whose major is German must have had at least three years of University German or its equivalent. They must take courses 101, 102, 103, and in addition six semester hours from among courses 8, 9, 25, and 27. For further work, any of the other courses described below, are open to graduate students.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

7. Heine's Prose; German Lyrics.—Rapid translation and sight reading of selections from Heine's Prose; study of lyric verse using as a guide Hatfields's German Lyrics and Ballads. I.; M., W., F.; (3). Assistant Professor Meyer.

8. Schiller.—The life of Schiller, and study of Wallenstein and other selections. I.; Tu., Th.; 3; (2). Assistant Professor Brooks.

9. Goethe's Faust.—Part I, and portions of part II. I.; M., W., F., 3; (3). Assistant Professor Meyer.

10. Goethe.—The life of Goethe, and study of selections

from his lyrics, classical dramas, and prose works, II.; M., W., F.; 7; (3). Assistant Professor MEYER.

11. HISTORY OF MODERN GERMAN LITERATURE.—Lectures, recitations, and reports on assigned collateral reading. II.; Tu., Th.; 7; (22). Assistant Professor BROOKS.

12. RECENT AND CONTEMPORARY PROSE FICTION.—Rapid reading of works by Freytag, Dahn, Keller, Heyse, Sudermann, and others. I.; Tu., Th.; 7; (2). Assistant Professor BROOKS.

23. THE ROMANTIC SCHOOL.—Rapid translation and sight reading; reports on assigned reading. I.; M., W., F.; 4; (3). Miss BLAISDELL.

24. RECENT AND CONTEMPORARY DRAMA.—Study of Dramas by Heyse, Hauptmann, Wilbrandt, Fulda, Sudermann, and others. II.; M., W., F.; 4; (3). Assistant Professor BROOKS.

25. TEACHERS' COURSE.—Lectures, discussion of methods, examination of text-books. II.; Tu.; 7; (1). Assistant Professor MEYER.

26. GERMAN LITERATURE BEFORE THE REFORMATION.—Lectures, recitations and reports on assigned reading; the course is intended to cover the period not included in course 11, and students who intend to take course 11, are advised to elect course 26. I.: Tu.; 8; (1). Assistant Professor BROOKS.

27. LESSING.—The life of Lessing, and study of Nathan der Weise and other selections. II.; M., W., F.; 3; (3). Assistant Professor MEYER.

COURSES FOR GRADUATES

101. INTRODUCTION TO MIDDLE HIGH GERMAN.—I.; M., W., F.; 8; 3. Assistant Professor BROOKS.

102. OLD HIGH GERMAN AND ELEMENTS OF HISTORICAL GRAMMAR.—II.; Tu.; Th.; 8; (2). Assistant Professor BROOKS.

103. SEMINARY IN MODERN GERMAN LITERATURE.—I. or II.; (2). Assistant Professor MEYER.

GREEK

The undergraduate courses offered in the Catalog constitute about six years' work. For registration with Greek as a graduate major, at least the first four years, or their equivalent, and an approved bachelor's degree are required.

Graduate minor courses are offered upon arrangement as follows: (a) the History of Classical Philology; (b) General Introduction to the Science of Language; (c) the Private and Public Life of the Greek People.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

9. Greek Oratory.—I.; M., W., F.; 4; (3). Professor Moss. *Required:* Greek 8.

10. Greek Tragedy.—I.; Tu., Th.; 2; (2). Professor Moss. *Required:* Greek 8.

11. Homer.—The Iliad.—II.; M., W., F.; 4; (3). Professor Moss.

Required: Greek 8.

12. Thucydides.—II.; Tu., Th.; 4; (2). Professor Moss. *Required:* Greek 8.

HISTORY

With a view to offering opportunities for advanced work with the sources, the documentary collections of the University Library have been greatly strengthened. The following complete, or nearly complete, collection of source-material may be specially noted:

American History.—The records of debates in Congress in their various forms from 1789 to the present time; the *Journals* and *Secret Journals* of the Continental Congress before 1789; the *American State Papers*, and the congressional documents or reports; the *U. S. Statutes at Large*; The U. S. Supreme Court reports; the colonial statutes of Massachusetts, New York, Pennsylvania, and Virginia; the legislative and judicial documents of Illinois; the collected writings, usually in the latest editions, of most of the "Fathers of the Republic" and of many of the late statesmen.

English History.—*The Statutes of the Realm*: House of Commons, *Journals*; Cabbeth, *Parliamentary History* and Hanson, *Parliamentary Debates*; the *Annual Register*; Pickering, *Statutes at Large*. The resources of the University Library are supplemented by those of the Champaign City Library which contains the books on western history, collected by the late Edward G. Mason, President of the Chicago Historical Society.

Though it is impossible to draw a hard and fast line between advanced undergraduate and graduate work, candidates for advanced degrees, with history as a major, must have had at least two years of undergraduate work in this subject. Work in the related social science will be accepted in partial substitution for that required in history.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

4. English Constitutional History.—I., II.; M., W., F.; 2; (3). Assistant Professor Schoolcraft.

8. The Empire and the Papacy in the Middle Ages. —The conflict of church and state. I., II.; M., W., F. Mr. Alvord.

9. The Period of the Italian Renaissance.—I.; Tu., Th.; 7; (3). Mr. Alvord.

10. The Development of the British Colonial Empire. —I.; M., W., F., 2; (3). Assistant Professor Schoolcraft. [Not given in 1904–05].

11. The Political History of Europe in the Nineteenth Century.—Professor Greene.

13. The Political and Constitutional History of the English Colonies in America.—Professor Greene.

14. The Constitutional History of the United States, 1775–1860.—Professor Greene.

15. The Political and Constitutional History of the United States since 1860.—Professor Greene.

101. The Seminary in American History.— Professor Greene.

102. The Seminary in English History.—Assistant Professor Schoolcraft.

Attention is also called to the courses in economic and financial history offered by the Department of Economics.

LATIN

Professor Barton

The work offered pre-supposes the usual four years' preparatory course and three years of regular college

work. The intensive study of one of the masterpieces of golden or silver Latin will be the basis of the work, supplemented by the study of the Roman novel as found in Petronius and Apuleius. Ansonius and Claudianus will also be considered. Historical Latin Grammar and the private life of the Romans are included in these requirements for the degree of Master of Arts.

PHILOSOPHY

One year's graduate work may, at present, be done in this department. In addition to the courses in philosophy, the student must select, under the guidance of the head of the department of philosophy, advanced courses in psychology, sufficient to complete a full course of study for the year.

The minimum preparation required for admission is a year's work in both psychology and philosophy.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

5. ADVANCED PHILOSOPHY.—The seventeenth century philosophy. A critical study of Descartes, Spinoza, and Leibnitz. I.; Tu., Th.; 7; (2). Professor DANIELS. [Not given in 1904-5].

Required: Two semesters in Philosophy of Psychology.

10. PHILOSOPHIC THOUGHT IN ENGLISH LITERATURE OF THE EIGHTEENTH AND NINETEENTH CENTURIES.—I.; Tu., Th.; 8; (1). Professor DANIELS.

11. PHILOSOPHY OF RELIGION.—The philosophical interpretation of religious consciousness, with reference to the value of a rational view of religious ideas. Open to seniors and graduate students only. I., II.; Tu., 7; (1). Professor DANIELS.

12. THE PHILOSOPHY OF HERBERT SPENCER.—A critical study of his First Principles and Data of Ethics. The influence of the theory of evolution upon modern philosophy. Open to seniors and graduate students only. I.; W., F.; 8; (2). Professor DANIELS.

13. PHILOSOPHY OF NATURE.—The study of scientific conceptions from the philosophic point of view. Man's place in

nature. The relation of mind and body. A critical study of selections from the writings of Clifford, Pearson, Ostwald, and other writers. Open to senior and graduate students only. II.; Tu., Th.; 8; (2). Professor DANIELS.

COURSES FOR GRADUATES

101. THE PHILOSOPHY OF KANT.

ROMANIC LANGUAGES

Graduate students are given ample opportunities to pursue advanced work in the Romanic Languages. The University Library contains a valuable collection of books in these subjects, including back files of the leading periodicals treating of French Literature and Romanic Philology. Additions are constantly being made, and special needs of graduate students will be met so far as possible. The minimum requirement of work previously done is three years of French. To this it is desirable to add courses in Spanish and Italian. In the higher courses intended primarily for undergraduates, additional requirements are made for graduates. The undergraduate courses in Italian and Spanish may be taken as graduate minors.

Prospective teachers of the Romanic Languages should take up the study of the history and development of these tongues. Such study is required of all candidates for the degree of Doctor of Philosophy in Romanic Languages. It is strongly recommended to all candidates for the degree of Master of Arts in this subject.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

3. ADVANCED FRENCH PROSE COMPOSITION AND CONVERSATION.—This course may be taken alone, or, more profitably, with any other course. It is especially designed for students in the courses in business training, and for those intending to teach French. I. II.; Tu., Th.; 2; (2). Professor OLIVER.

4. Nineteenth Century.—A general course on the romantic and realistic novel and drama. Lyric poetry forms also an important share of the work. Modern tendencies are discussed. Lectures, themes, and collateral reading. I., II.; M., W., F.; 2; (3). Mr. Hamilton. [Not given in 1904-5].

5. The Romantic School.—Rise, development and decline of Romanticism in French literature with readings from all representative authors. During the latter part of the year, the characteristics of realism are discussed, and a few productions of the realistic school are read. I., II.; M., W., F.; 2: (3). Mr. Hamilton.

7. Moliere.—Study of the life and times of Molière with reading of the greatest comedies. I.; Tu., Th.; 2; (2). Mr. Hamilton. [Not open to students who have taken French 10].

8. Tragedy of the Classic School.—Rise, development and decline of Classic Tragedy as seen in the works of Corneille, Racine, and Voltaire. II.; Tu., Th.; 2; (2). Mr. Hamilton. [Not open to students who have taken French 10].

9. Non-dramatic Literature of the Seventeenth Century.—Lectures on the culture and society of France in the seventeenth century as expressed in literature not dramatic. The great moralists and philosophers. Memoirs and letters. The Art Poétique and the Satires of Boileau. The fables of La Fontaine. I., II.; M., W., F.; 4: (3). Professor Oliver.

10. Seventeenth Century Drama.—Lectures on the rise and development of French Classic Drama with especial reference to the society of France during this period. Interpretation of the greater masterpieces of Corneille, Racine, Molière and the secondary dramatists. Collateral reading and themes. I., II.; M., W., F.; 4; (3). Professor Oliver. [Not given in 1904-5].

Required: "Twenty hours" credit exclusive of French 7 and 8.

11. Lyric Poetry of France.—The chief emphasis is laid upon Victor Hugo, but poets previous to him are also studied as well as his chief contemporaries and successors. The principles of French versification particularly as exemplified in Hugo and other Romantic writers are studied. I., II.; Tu., Th.; 3; (2). Dr. Jones.

12. Realistic Fiction.—Taking Balzac as its center this course treats in detail the development of French realistic fiction. I., II.; Tu., Th.; 3; (2). Dr. Jones. [Not given in 1904-5].

13. Non-Dramatic Literature of the Eighteenth Century.—Lectures on the society and culture of the eighteenth century. Break-up of the ideals of Classicism. Growth of the Revolutionary spirit. First movements toward Romanticism. Montesquieu, Voltaire and the Encyclopedists, Rousseau, Diderot, Le Sage, and the writers of the Revolution. I., II., M., W., F.; 4; (3). Professor Oliver. [Not given in 1904-5].

14. The Drama of the Eighteenth and Nineteenth Centuries.—The decadence of Classic Drama:—Voltaire—Crébillon. Rise and growth of the *drame bourgeois*, the Romantic drama and the realistic drama. Modern tendencies. The chief works of Beaumarchais, Marivaux, Hugo, Musset, Scribe, Dumas *père*, Augier, Dumas *fils*, Sardou, Coppée, Becque, Hervieu, Rostand, Brieux. Collateral reading with essays. I., II.; M., W., F.; 4; (3). Professor Oliver. [Not given in 1904-5].

COURSES FOR GRADUATES

101. The Sixteenth Century.—The Reformation and the Renaissance. Rabelais, Calvin, Marot, Ronsard, and the Pleiade, Montaigne. Readings from Darmsteter and Hatzfeld's "Le Seizième Siècle en France". Study of the language and syntax of the period. I.; (3). *Arrange time.* Professor Oliver.

102. French Historical Grammar.—Phonetics morphology, syntax. Illustrative readings from Old French texts. I., II.; (3). *Arrange time.* Professor Oliver.

103. History of Old French Literature.—With representative readings from Bartsch's Chrestomathie, La Chanson de Roland, Chrestien de Troyes and other works. The Mediæval drama. I., II.; (3). *Arrange time.* Professor Oliver.

104. Comparative Historical Grammar of the Romanic languages with especial reference to Old French and Provençal. —Illustrative readings. I., II.; (3). *Arrange time.* Professor Oliver.

SUBJECTS OF THE COLLEGE OF SCIENCE

BOTANY

Professor Burrill and Assistant Professor Hottes

Graduate botanical studies may be pursued in several lines for which the facilities of the laboratories are ample and the opportunities are in every way sufficient to meet the needs of advanced workers in plant histology, physiology, physiological cytology, pathology, morphology, ecology, and bacteriology.

The undergraduate courses are numbered from 1 to 12 and carry credits aggregating 60 semester hours or five full years' work. Course 11 is a general introductory one of 5 "hours," (one semester) open without other restrictions than the University entrance requirements, to all matriculated students. Zoology 10 is a similar introductory course of 5 "hours" and these together, or their equivalent, one year of biological work, constitute a minimum pre-requisite for minor graduate registration. Courses 1 to 10 are therefore open to graduates as minor subjects. Courses 1 and 2, following 11, cover one year, and these or their equivalent are required for major graduate credit. Courses 3 to 10 inclusive may be approved, with any additions specified in individual cases, for major graduate work towards a master's degree. Registration for a doctor's degree may be accepted on the same basis, but in this case study must be so specialized as early to permit effective research. Those having sufficient preparation will be enrolled at once for major work in one or more of the courses marked for graduates. These are research courses and the work is adapted to the special purposes or requirements of each investigator.

The collections in the Herbarium are in convenient order for reference and include materials for research in several

subjects. Of fungi there are over 30,000 mounted specimens together with a large amount of duplicate material.

3. Cytology and Physiology. — Mostly laboratory work and assigned reading. The course extends through the year, but the work of each semester may be credited separately under the designations of 3a and 3b. The first semester is devoted mainly to cytology and histology, with special attention to technique; during the second semester experimental physiology receives chief attention. I., II.; 3, 4: (5). Assistant Professor Hottes.

Required: Botany 1.

4. Taxonomy of Special Groups. — Mostly laboratory and herbarium work, and assigned reading. Field excursions are required. The course extends through the year, but the work of each semester may be credited separately under the designations of 4a and 4b. The first semester is devoted mainly to spermaphytes, the second to sporophytes. I., II.; 1, 2; (5). Professor Burrill.

Required: Botany 2.

5. Bacteriology. — An introduction to the knowledge of the subject and instruction in methods. II.; 3, 4; (5). Professor Burrill and Miss Latzer.

Required: Chemistry 1, and at least one semester's work in botany or zoology, in the University.

7. Plant Pathology. — Diseases and injuries of plants. Mostly laboratory, herbarium, and field work, and assigned reading. I.; M., W., F; 1, 2; (3). Professor Burrill.

Required: Botany 1, 2.

9. Investigations and Thesis. — Research work upon selected subjects. Special arrangements for this work should be made during the preceding year. I., II.; *arrange time*; (5). Professor Burrill and Assistant Professor Hottes.

Required: Botany 1, 2, and at least one year from 3, 4, 5, 7.

10. Seminary. —Reports and discussions upon assigned topics and results of research work. For advanced and graduate students. I. II.; F.; *arrange time.* (1). Professor Burrill.

COURSES FOR GRADUATES

101. Biological Botany. — The preparation and study of material by histological and embryological methods, and exper-

iment work with living vegetation in the laboratory and field in working out special problems in the development, physiology, and pathology of plants. Assistant Professor HOTTES.

102. SYSTEMATIC BOTANY. — Critical and comparative studies of species included in chosen groups of spermaphytes or sporophytes, or from selected geographic areas, in connection with considerations of genealogic development, geographic distribution, and interrelated association. Professor BURRILL.

103. BACTERIOLOGY. — Investigations upon morphologic and physiologic variation due to treatment; systematic studies upon the number, validity, and relationship of species, researches upon special saprophytic or parasitic kinds of bacteria and upon methods of favoring or combating their activities. Professor BURRILL.

104. EVOLUTION OF PLANTS. — Observations and experiments upon plants and studies in related literature, in gaining information upon such topics as the following: The influence of environment, effects of self and cross fertilization, tendencies of variation, philosophy of selection, nature and laws of heredity. Professor BURRILL and Assistant Professor HOTTES.

CHEMISTRY

Special opportunities and facilities are afforded properly prepared students, to undertake graduate work in all lines of pure and applied chemistry. The commodious, new chemical building, with its large laboratories and separate research rooms is well equipped for graduate work in inorganic, organic, physical, agricultural, and applied chemistry. In combination with certain engineering courses special facilities are available to students wishing to do graduate work in electro-chemistry and in chemical engineering. The requirement for major graduate work in the Departments of Chemistry is the baccalaureate degree of this University or its full equivalent.

COURSES FOR GRADUATES

101. ORGANIC CHEMISTRY. — Special investigations in the aliphatic or in the aromatic series. Associate Professor GRINDLEY and Dr. DEHN.

102. Inorganic Chemistry. — Research work in general inorganic chemistry, including the critical and constructive study of methods of analysis, both quantitative and qualitative. Professor Parr, Associate Professor Grindley, and Dr. Lincoln.

103. Physical Chemistry.— Investigation of special problems, including thermo-chemical research. Dr. Lincoln.

104. Chemistry of Foods. — Investigations of the composition, fuel value, digestibility, and dietary value of foods, and the chemical changes involved in cooking. Associate Professor Grindley.

105. Agricultural Chemistry. — Special investigations in the field of agricultural chemistry, including the chemistry of plants, foods, soils, and rain, drain, and ground waters. Associate Professor Grindley and——

106. Research in Metallurgical Chemistry.—(a) Action of solvents in extraction of gold and silver from their ores. (b) Methods of analysis of ores and products. Professor Parr.

107. Investigation of Water Supplies.— In connection with State Water Survey. Mr. Stark.

108. Investigation of Fuels—

(a) Heating power, calorimetric methods.

(b) Adaptation of bituminous coal to gas manufacture, purification of products.

(c) Coke and by-products.

Professor Parr.

109. Special Problems in Industrial Chemistry.—

(a) Corrosion and scaling of steam boilers.

(b) Purification of feed water.

(c) Cements and mortars.

(d) Paints and pigments.

Professor Parr.

GEOLOGY

The undergraduate courses offered in this department cover a wide field. Each of the semester courses, mineralogy (Geol. 5), general geology as taken by chemists, or as taken by general science students (Geol. 1), agricultural geology (Geol. 12), engineering geology (Geol. 13), or physical geography (Geol. 8), looks toward, and is pre-

paratory for a different line of advanced work. The equipment of the department enables us to offer excellent facilities for advanced study along each of these lines.

To the agriculturist there is offered studies in the mineralogical composition of soils carried on by the use of the microscope and other optical agencies; in mineral and rock decomposition; and in meteorology: to the engineer and chemist, studies in the characteristics, origin and methods of deposition of all useful minerals, together with the uses which are made of them; in the testing of mineral substances used in the manufacture of structural materials, by physical methods; in mineral synthesis; and in petrography; to the biologist, studies in paleontology, using our unusually large collection of paleozoic forms; in organic evolution from the standpoint of the geologist; and in the distribution of organisms as affected by geographic influences: to the teacher, studies in the geology and physical geography of selected regions with special reference to their influence on the welfare of mankind; and of methods for observational and laboratory work in these subjects which are best adapted to the needs of students in secondary schools: to the student of general science such selection from the above as will best promote the object he has in view.

At least one semester of apporpriate introductory work, as offered in University courses, or the equivalent, is required for graduate registration. The courses open to undergraduates may be taken for minor graduate credit, or with approved additions, for major work.

2. Economic Geology.—A study of the uses man may make of geologic materials; of the conditions under which they occur, and those under which they were formed; and of the qualities which make them valuable. Readings, conferences, and laboratory work.

Each student may select one or more of the subjects indicated below and devote so much time to it as may seem desirable or profitable. The proportion of time devoted to reading, conference and laboratory will of course vary with the nature of the subject chosen. The laboratory affords facilities for making the work thoroughly practical.

Ores and ore deposits, useful minerals other than ores, mineral synthesis, petrographic studies, properties of clays which fit them for various uses, properties of lime and cement-making materials; properties of building stones; rock-flours and their uses, origin, and uses of road metals, studies of ornamental stones, coals and coal basins, hydrographic studies, etc., either, or both semesters, (2, 3, or 5). Professor WOLFE, Mr. FOX, and Mr. MATSON.

4. INVESTIGATIONS.—Students desiring to take advanced work in any department of dynamic or historical geology, in mineralogy or in physical geography may, with approval, select a subject for investigation and receive such guidance and help as may be necessary. Readings, conferences, laboratory and field work are apportioned according to the nature of the subject. The work is individual, and the student is expected to show results. Either semester: (3 or 5). Professor ROLFE, Mr. FOX, and Mr. MATSON.

6. ADVANCED CRYSTALLOGRAPHY.—During the first part of the semester a detailed study of the forms of crystals, their combinations and abnormalties is made. Later the student learns to measure the facial angles of crystals with the contact and reflecting goniometers and by mathematical calculations to determine the species. I. Tu., Th.; 3-4; (2). Professor ROLFE, and Mr. FOX.

7. OPTICAL MINERALOGY.—The student is first made acquainted with the peculiarities of the petrographic microscope, and of the behavior of minerals in thin section in parallel and convergent light. He then places thin sections of minerals and rocks under the microscope and learns to determine their species and the changes which are taking place in them by their effect on transmitted light. I.; M., W., F. 3-4; (3). Professor ROLFE, and Mr. FOX.

9. ADVANCED PALEONTOLOGY.—This course includes (a) discussion of the biological relations of fossils form along the lines

indicated in Williams' Geological Biology: (b) discussion of the principles of classification as applied to fossils, together with the characteristics which distinguish the larger groups, using Nicholsom, Bernard, and Zitti as guides; (c) study of the distribution and variations of the genera and species of one or more of the important groups as illustrated by the collections of the University. Either semester; 3-4; (5). Professor ROLFE, Mr. FOX, and Mr. MATSON.

10. TEACHER'S COURSES IN PHYSICAL GEOGRAPHY.—This course is designed primarily for those who expect to teach. The work includes discussions of the most approved methods of presenting each topic in class room, field, and laboratory, and the use which can be made of local geography, topography and geology together with the fauna and flora as illustrative material. It also includes the selection of topographic sheets issued by the United States Geological Survey which show well developed topographic types, and their proper use in the class room; the manufacture and use of models and all other means by which the principles of the science may be experimentally studied. It further includes observations on character of cloud, direction and velocity of wind, temperature and humidity of the air, and their relation to weather changes; the study of weather maps, and the constitution and use of simple apparatus for meteorological observations. A study is made of the geographic elements which have combined to produce the peculiarities of surface and climate of selected regions and the effect which these combinations have had on the historical, commercial and industrial progress of their inhabitants. I.; *arrange time.* (5). Professor ROLFE, and Mr. MATSON.

COURSES FOR GRADUATES

102. ECONOMIC GEOLOGY.—The laboratories afford facilities for the study of problems in economic geology by the most approved methods. These problems may be approached from the geological side only in the laboratories of the department, or may be carried on under the joint direction of the departments of geology and applied chemistry. Again they may be purely laboratory problems, or the student may make an economic survey of some assigned area.

104. DYNAMIC GEOLOGY.—The dynamic problems in Illinois geology have scarcely been touched except on the glacial side.

There are many problems in stream work, pre-glacial drainage, tracing moraines of Illinois glaciation, water supply, peneplanation, deserted lake beds, the Ozark ridge, etc., that await solution. The University offers excellent facilities for work along these lines.

108. PHYSICAL GEOGRAPHY.—Studies in the geography of Illinois dealing with the topography, meteorology, climatology, and natural products of assigned areas.

HOUSEHOLD SCIENCE

The University affords unusual facilities for advanced work in this department. The equipment of the department has been carefully selected and much illustrative material has been secured. In addition to the laboratories of the department, the resources of the library, the investigations of the well equipped science laboratories, the researches of the department of economics, are available for the use of the student.

At least one year of acceptable household science work is required for graduate registration. Courses open to undergraduates will have additions for graduate credit.

COURCES FOR ADVANCED UNDERGRADUATES AND GRADUATES

4. CHEMISTRY OF FOOD AND NUTRITION.—Food and nutrition from the standpoint of sanitary and physiological chemistry. Investigations in the study of yeasts; household applications of bacteriology; dietaries adapted to different ages, occupations and conditions. *Richard and Woodman's Air, Water, and Food; Halliburton's Essentials of Chemical Physiology; Government Bulletins.* I.; M., W.; 3., 4.; Tu., Th., F.; 3; (5). Professor BEVIER.

Required: Bot. 5. Chem. 1, 3b, 4, 5c, 20; 5 hours in Botany or Zoology.

5. DIETETICS AND HOUSEHOLD MANAGEMENT.—The topics considered are: (a) the principles of diet; the relation of food to health; the influence of age, sex and occupation; the dietic treatment of certain diseases; principles of home nursing. (b) The organization and care or the household; the processes involved in the cleaning of metals, woods, and fabrics; the use of disinfectants. II.; M., W., F.; 5; (3). Miss BEATTY.

Required: Household Science 1, 6.

6. Economic Uses of Food.—This course is a continuation of course 1. Emphasis is put upon the economic side of the food question. The uses and applications of preservatives are considered. I.; M., W., F.; 1, 2; (3). Miss Beatty.

Required: Household Science 1.

8. Personal and Public Hygiene.—This course is intended to be a popular presentation of the results of late investigations in regard to food and sanitation. II.; Tu.; 7; (1). Professor Bevier.

9. Seminary.—Reports and discussions upon assigned topics. For advanced students. I., II.; W.; *arrange time*; (1) Professor Bevier.

101. Home Economics.—A study of the origin and development of Home Economics in its various phases. Particular attention is given to its industrial, educational and sociological aspects. Professor Bevier.

102. Special Investigations.—Problems in the application of the principles of bacteriology, chemistry and physiology to the ordinary processes used in the preparation of food. Professor Bevier and Mrs. Sober.

MATHEMATICS

The University offers an opportunity for pursuing graduate work in mathematics for two or three years. The minimum requirement for entering upon this work includes three years of undergraduate study in the same line. It is recommended that students anticipating graduate work at this University shall take, in addition to the above requirements in mathematics, a year of experimental physics and when possible a half year in mechanics. Students making their major in mathematics may with profit elect at least one of their minors from the allied subjects in engineering, physics, or astronomy.

The University Library contains complete sets of the leading French, German, English, and American mathematical journals. It also contains the most important collected works and treatises, particularly in the line of theory of functions and in geometry. The department is

supplied with a collection of models for use in geometry and in the theory of functions. Research work in these two lines is amply provided for. In connection with the preparation of a thesis, all graduate students in mathematics are required to be members of the mathematical seminar (Math. 15) where the results of their investigations are presented and discussed.

Aside from the following courses, which are regularly offered to advanced undergraduates, work will be given in continuous groups, and definite integrals, if the demand for these subjects seems to warrant it.

12. Theory of Invariants.—The general development of the theory of invariants, both from the geometric and from the algebraic side. Applications of invariants to systems of conics and higher plain curves. I.; M., W., F.; 7; (3). Dr. Rietz.

Required: Mathematics 8b (or 9), 11.

13a. Functions of Real Variables.—The two courses in functions (13a , 13b) are a continuation of the work done in calculus (8a, 8b, or 7, 9). Under functions of real variables, considerable attention is given to the fundamental ideas of the analysis, including rational and irrational numbers, mengelehre, single and double limits and their application to questions of continuity of functions of one and two variables, uniform convergence of series, etc. The existence of derivities, condensation of singularities, definite integrals, differentiation and integration of series are also discussed. I., II.; M., W., F.; 8; (3). Associate Professor Townsend.

Required: Mathematics 8a, 8b, (or 7, 9,) 10.

13b. Functions of a Complex Variable.—A general introduction to the theory of functions of a complex variable. The methods of Weierstrass and Riemann are followed. I., II.; M., W., F.; 8; (3). Associate Professor Townsend.

Required: Mathematics 8a, 8b (or 7, 9,) 10.

14. Method of Least Squares.—The fundamental principles of the subject. The following subjects are studied: Law of probability and error, adjustment of observations, precision of observations, independent and conditional observations, etc. I.; Tu., Th.; 6; (2). Dr. Stebbins.

Required: Mathematics 8a, or 9.

15. Seminary and Thesis.—I., II.; Tu., Th.; 8; (3). Associate Professor Townsend.

18. Higher Plane Curves.—This course includes the general theory of algebraic curves, together with the application of the theory of invariants to higher plane curves. Special study is made of curves of the third and fourth order. II.; M., W., F.; 7; (3). Dr. Rietz.

Required: Mathematics 12.

20. Calculus of Variations.—This course has for its aim merely to acquaint the student with those elements of the science which are most needed in the study of the higher subjects of mathematical astronomy and physics. II.; M., W., F.; 4; (3). Professor Shattuck.

Required: Mathematics 11, 16.

21. Spherical Harmonics.—This course is introduced by a short course of lectures and study of certain trigonometric series. Fourier's Theorem for developing any function of a variable in a series proceeding in sines and cosines of multiples of the variable is derived and the limitations of its validity investigated. This is followed by the study of Lagrange's, Laplace's, and Lamé's functions and their applications to astronomical and physical problem. I.; M., W., F.; 6; (3). Assistant Professor Hall or Mr. Brenke.

Required: Mathematics 11, 14, 16.

22. Potential Function.—The potential function is defined and its properties derived and discussed. The potential of various bodies, such as wire, a spherical shell, a sphere, ellipsoid of revolution, etc., is computed. Poisson's and Laplace's Equations are derived and discussed. Green's propositions with kindred and similar subjects are considered. II.; M., W., F.; 6; (3). Assistant Professor Hall or Mr. Brenke.

Required: Mathematics 21.

23. Modern Geometry.—This course includes, in general, a consideration of homogeneous coordinates, duality, descriptive and metrical properties of curves, anharmonic ratios, homography, involution, projection, theory of correspondence, etc. I.; M., W., F.; 7; (3). Mr. Coar.

Required: Mathematics 8a or 7, 11.

24. Algebraic Surfaces.—In this course are considered the

application of homogeneous coordinates and the theory of invariants to geometry of three dimensions, and also the general theory of surfaces, together with the special properties of surfaces of the third and fourth order. II.; M., W., F.; 7; (3). Mr. Coar.

Required: Mathematics 17, 18.

25. Partial Differential Equations.—It deals with the integration and determination of the integration constants of such partial differential equations as arise in the study of such subjects as the flow of heat, the vibration of strings, plates, etc., and electricity. II.; Tu., Th.; 7; (2). Associate Professor Townsend.

Required: Mathematics 8a or 9, 16.

PHYSICS

The advanced work in physics is both experimental and theoretical. The Physics Laboratory is equipped with the necessities and conveniences for experimental work. In addition to the large lecture and laboratory rooms arranged for the elementary undergraduate courses, a large space on the first floor is conveniently divided into rooms for advanced experimental work. These include six rooms with heavy masonry piers, a constant temperature room, a chemical preparation room, three rooms for spectrum, photometric and photographic work, and a well-equipped machine shop. The cabinets of the department contain fine standard apparatus from the best makers for work in the various branches of physics. The equipment for work in heat and in electricity and magnetism is especially strong, much new apparatus having been added recently. The services of a mechanician give means of constructing special apparatus needed for investigational work of graduate students and instructors. The literature of physics is also available, as the University Library contains not only the standard treatises and manuals of reference, but also sets of practically all of the English, French, and German journals in physics and the cognate subjects of chemtry and mathematics.

One year of University physics, including laboratory courses, and corresponding training in mathematics or chemistry, will ordinarily be accepted for admittance to graduate work in physics. Courses open to undergraduates will have additions for graduate credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

5. ADVANCED EXPERIMENTAL PHYSICS.—This includes the following separate courses: (5a) Mechanics; (5b) Light; (5c) Electricity and Magnetism; (5d) Heat. Each course I. or II. semester; *time to be arranged*; credit to be 2, 3, or 5 hours. Professor CARMEN and Assistant Professor KNIPP.

5. THEORETICAL PHYSICS.—This includes five courses on the elementary mathematical theory of physics. A knowledge of the elementary methods of the calculus is desired. (6a) Mechanics; (6b) Light (Preston's light); (6c) Electricity and Magnetism (Thomson's Elementary Mathematical Theory); (6d) Heat (Preston's Heat): (6e) fluids. Each course 3 or 5 hours' credit. *Semester and hours to be arranged.* Professor CARMEN, Assistant Professor KNIPP, and Dr. WATSON.

7. INVESTIGATION OF SPECIAL PROBLEMS.—I. and II.; *time to be arranged*; 3 or 5 hours' credit. Professor CARMEN, Assistant Professor KNIPP, and Dr. WATSON.

8. MATHEMATICAL PHYSICS.—*Semester and hours to be arranged*; 3 or 5 hours' credit. Professor CARMEN.

COURSES FOR GRADUATES

101. ADVANCED PHYSICAL MEASUREMENTS AND INVESTIGATION.—This is work in advance of courses 5 and includes the experimental work in preparation of a thesis. *Both semesters, with hours and credit to be arranged.* Professor CARMEN, Assistant Professor KNIPP, and Dr. WATSON.

102. MATHEMATICAL PHYSICS.—*Work and hours to be arranged.* Professor CARMEN.

103. MATHEMATICAL THEORY OF ELECTRICITY AND MAGNETISM FOR ENGINEERS. Professor Carmen and Assistant Professor KNIPP.

PHYSIOLOGY

The equipment of the laboratory includes a considerable number of instruments of precision giving facilities of

research along certain lines as good as can be found in the country. Graduates interested in certain problems, especially such as are connected with the blood and its circulation and respiration, may profitably spend one or more years in advanced investigations, in or beyond courses described below.

Registration for major credit requires at least one year of undergraduate work in the subject, viz., course 1, or an equivalent; but for those who have the requisite training in chemistry, physics, and zoology any of the courses 1, 2, 3, or 5 may be accepted for minor credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

2. ADVANCED COURSE.—Continuation of Physiology 1 through a second year. This course is designed for students who wish to get as thorough a training as possible for the study of medicine, and who can afford to take the full science course at the University leading to the B. S. degree. Lectures, assigned reading, and experiments in the laboratory conducted by the students under the supervision of the instructor. I., II.; *daily* 3, 4; (5). Professor KEMP.

3. INVESTIGATION AND THESIS.—Every facility and encouragement, so far as the resources of the laboratory permit, are offered to those prepared to avail themselves of these for researches leading to theses for the bachelor's, master's or doctor's degree, or for carrying on original work for publications.

4. MINOR COURSE.—Especial emphasis is laid upon those facts that serve as a basin for practical hygiene, and for helping students to teach physiology in high schools. Lecture demonstrations, recitations, and laboratory work. Students who have had chemistry and zoology in high schools may be admitted to the course at the option of the instructor. II.; *daily*; 7, 8; (5). Professor KEMP.

Required: Chemistry 1, zoology 10.

5. SPECIAL PHYSIOLOGY.—There are here included the following lines of laboratory work, any one or more of which may be pursued independently of the others: (a) The physiology of foods, and digestion; (b) the blood, circulation, and respiration;

(c) the excretions, especially urine analysis; (d) general physiology of nerve and muscle; (e) advanced vertebrate, especially human, histology. This course may be taken after physiology 4, and is recommended for those who wish to work a year in physiology without having the requirements to enter the class in physiology 1. It may also be taken for less than five credits. Work to be arranged after consultation with Professor KEMP.

ZOOLOGY

Zoology may be taken as a graduate minor by a student who has taken the introductory courses in zoology and botany (zoology 10 and botany 11), which together make one year's work. It may be taken as a graduate major by one who has taken zoology 10 or its equivalent followed by course 1 (invertebrate zoology) or course 2 (vertebrate zoology and comparative anatomy), one year's college work in all.

The courses hereinafter described may be taken as minors or majors for either the master's or the doctor's degree. For the master's degree any one of courses 1 to 9, and 12 to 17 of this list may be counted as a minor, and any series of these courses amounting to ten semester hours may be taken as a major. Whether or not a research course followed by a thesis will be required for the master's degree will depend, in each case, on the undergraduate work of the candidate, and the approval of the University Committee on the Graduate School. The course leading to the doctor's degree with zoology as a major should comprise, as a rule, all the above courses, together with a research course of at least one year, the results of which are to be embodied in the dissertation. A selection of minor courses should be made with reference to the candidate's previous studies, and will be subject to the approval of the committee on the Graduate School.

Graduate students in this department have access to the important and extensive special libraries and eollcctions

of the State Laboratory of Natural History, housed in the Natural History Building.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

1. INVERTEBRATE ZOOLOGY.—This course is largely given to the study of common invertebrate animals of Illinois, with special attention to their distribution, habits, life histories, and adaptive structures. A few type forms are studied additional to those of the elementary course. Field work and its methods are included in the course, the work of which is adapted throughout to the needs of prospective teachers. I.; lecture, M., W., F.; 4; laboratory, 7 periods; 3 and 4; (5). Professor FORBES and Dr. PETERS.

Required: Art and Design 1; an entrance credit in chemistry or chemistry 1; zoology 10.

2. VERTEBRATE ZOOLOGY AND COMPARATIVE ANATOMY.—In the laboratory work of this course principal attention will be given to the anatomy of Necturus and to anatomical and systematic studies of fishes, birds, and mammals, especial reference being had to the anatomy of man. The more difficult parts of laboratory technology will be given in this course, which will also contain lectures on the general theory of organic development as illustrated by the doctrine of the descent of man. I.; lecture, M., W., F.; 4; laboratory, 7 periods; *arrange time*; (5). Assistant Professor SMITH and Dr. PETERS.

Required: The same as for zoology 1.

3. VERTEBRATE EMBRYOLOGY.—This course begins with a study of the sex cells and a discussion of theories of heredity, followed by a consideration of the early stages in the development of the egg. The formation of the vertebrate body is then studied in the amphibian, the chick, and the pig. Instruction is given in the preparation of embryological material and in graphic reconstruction from serial sections. II.; 3, 4. (5). Dr. PETERS.

Required: Zoology 2.

15. VARIATION AND HEREDITY.—A course of lectures and reference reading designed to give a general survey of the results obtained by the application of modern statistical methods in the study of variation and heredity. A knowledge of the methods is acquired from lectures and from exercises in handling data gathered from various sources. Mendel's principles and the theory

of mutations are discussed. For accompanying laboratory work see 15a. II.; *arrange time*; (2). Assistant Professor SMITH.

Required: Zoology 10 or 11.

15a. STATISTICAL DATA.—Laboratory work involving the collection of data suitable for a study of the variations and correlations of structures in some suitable organism may be elected in connection with course 5. The extensive collections of insects, fishes, and plankton material in the possession of the state Laboratory of Natural History are available for the purposes of this course. II.; *arrange time*; (1 to 3).

Required: Zoology 10 or 11.

17. FIELD ZOOLOGY.—A course in which the main object will be to gain as comprehensive a knowledge as practicable of the animal life of a restricted locality. Collection, preservation, and identification of the various kinds of animals, together with observations on the habits, life histories, and relations to environment of selected forms will constitute the major part of the work. The phases of the subject receiving most attention will vary with the make-up of the class and with the kind of locality selected, but in any event the work will be so planned as to make it a desirable course for prospective teachers of zoology. The organization and management of the work will be such that graduate students intending to work subsequently on special groups, as plankton forms, annelids, or fishes, can give especial attention to such groups, if found desirable. II.; *arrange time*; (3). Assistant Professor SMITH.

Required: Zoology 10 or 11, and 1 or 2.

8. THESIS INVESTIGATION.—Candidates for graduation who select a zoological subject as a thesis are required to spend three hours a day during their senior year in making a detailed investigation of the selected topics. While this work is done under the general supervision of an instructor, it is in its methods and responsibilities essentially original work. I., II.; *arrange time*; (5). Professor FORBES and Assistant Professor SMITH.

Required: Two years in zoological courses, including one semester of zoology 4.

12. STATISTICAL ZOOLOGY.—This course is offered for students taking mathematics 26. It includes lectures and reference reading on the application of statistical methods to biological problems. The history of the development of this mode of biological investigation, the nature of the problems to which it is applicable

and some of the results already obtained in the study of variations, heredity, distribution and phylogeny are among the topics considered. Students taking this course, together with mathematics 26b, ordinarily use for the problems of the latter course, zoological data that have been obtained either by their own observations or from other sources. If desired the combined credits of this course and mathematics 26 may be counted as 5 credits either in zoology or in mathematics. II.; F.; 7; (1 or 5). Assistant Professor SMITH.

Required: Mathematics 2, 4, 6, 8a, and at least ten hours of University work in zoology, or in zoology and entomology.

14. GERMAN READINGS.—A study of zoological literature in German intended to give technical information and practice of accurate and rapid reading. This course, together with botany 13, will be accepted instead of German 6 of the prescribed list of all except students in chemistry and chemical engineering. I., II.; *arrange time*; (2). Assistant Professor HOTTES.

Required: German 4.

COURSES FOR GRADUATES

101. PLANKTON ZOOLOGY.—Instruction and practice will be given in modern methods of studying minute forms of aquatic life with the aid of a plankton apparatus and laboratory equipment. This work includes both a qualitative and a quantitative investigation of the minute zoological contents of a selected body of water, carried on systematically through a considerable period, and the generalization of the results of such study by the methods peculiar to the planktologist.

102. FRESH-WATER ICHTHYOLOGY.—The large collections of fishes belonging to the University and the State Laboratory of Natural History, together with the ichthyological library of the latter, are open to students who wish to become acquainted with the ichthyological of a fresh-water situation. Both qualitative and quantitative studies of the fishes of a selected body of water are made, and papers written presenting the results of personal studies in this field.

103. FRESH-WATER AND TERRESTRIAL ANNELIDS.—This is an application of the methods of the zoological laboratory to the study of the annelid worms of the land and the inland waters of North America. The description of genera and species, practice in drawing for publication, and experimental work on the physiology and ecology of selected forms will be included in this course

SUJBECTS OF THE COLLEGE OF AGRICULTURE

AGRONOMY

The instruction offered in the department of agronomy covers the subjects of soil fertility, soil physics, soil bacteriology, crop production, plant breeding, and farm mechanics. The department is also conducting extensive investigations relating to soils and crops. A considerable number of advanced students are employed during the summer season in connection with soil fertility investigations, the detail survey of Illinois soils, experimentation with corn and other field crops, etc., their time being devoted to study during the winter season.

The facilities for graduate work include an analytical laboratory for analyzing soils, crops, and plant food materials, extensive greenhouses erected specifically for studying soil fertility by pot cultures, well equipped and commodious laboratories for the study of soil physics, soil bacteriology, plant breeding and seed testing. Aside from the large number of experiment fields which are located in many different parts of the state, the department is conducting extensive field experiments covering about one hundred acres of land on the University farm at Urbana, some of which have been in progress for nearly thirty years. Besides these regular Experiment Station fields, which are made use of in giving instruction, there are certain fields which are reserved for student experiments.

Good instruments are provided for surveying lands in working out systems of tile drainage, and two large laboratories (40 by 116 feet each) are well equipped with the various kinds of farm implements including field machinery, windmills, power spraying machines, gas engines, and other power machines and hand tools used on the

farm. Many students taking advanced work in farm mechanics are employed during the summer season as machinery experts by different harvesting machine companies. For registration in major graduate work at least two years' undergraduate study in agronomy and the requisite special preparation is required.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

7. Special Crops.— A special study of farm crops taken up under an agricultural outline—grain crops, root crops, forage crops, sugar and fiber crops—their history and distribution over the earth, methods of culture, cost of production, consumption of products and residues, or by-products. Class work supplemented by practical field work and a study of the results of previous experiments, such as detasseling corn, injury to roots of corn by cultivation; selection of seeds of farm crops; special reference to Illinois conditions. II.; *daily*; 3, 4.; (5). Mr. Hume.

Required: Agronomy 2, 5, 6.

8. Field Experiments.—Special work by the students, conducted in the field. This work consists in testing varieties of corn, oats, wheat, potatoes, and other farm crops; methods of planting corn, seeding grains, grasses, and other forage crops; culture of corn, potatoes, and sugar beats; practice in treating oats and wheat for smut, and potatoes for scab, and studying the effects upon the crops; combating chinch bugs and other injurious insects. Other practical experiments may be arranged with the instructor. Special opportunities will be given to advanced students of high class standing to take up experiments, under assignment and direction of the instructor in crop production, on certain large farms in the state, arrangements having been made with farm owners or managers for such experiments. II.; *second half, and summer vacation*; *daily; arrange time* (2½–5). Mr. Hume.

Required: Agronomy 7, 12.

10. Special Problems in Soil Physics.—This work is intended for students wishing to specialize in the study of the physical properties of soils, and includes the determination by electrical methods of the temperature, moisture, and soluble salt content, of various soils under actual field conditions; effect of different depths of plowing, cultivation, and rolling, on soil

conditions; effects of different methods of preparing seed beds; the physical questions involved in the formation and redemption of the so-called "alkali," "barren" or "dead dog" soils, and of other peculiar soils of Illinois. II.; *or summer vacation; daily; arrange time*; (2 to 5). Mr. MOSIER.

Required: Agronomy 9, and one semester's work in geology.

13. INVESTIGATION OF THE FERTILITY OF SPECIAL SOILS.— This course is primarily designed to enable the student to study the fertility of those special soils in which he may be particularly interested, and to become familiar with the correct principles and methods of such investigations. It will include the determination of the nature and quality of the elements of fertility in the soils investigated, the effect upon various crops of different fertilizers added to the soils as determined by pot cultures, and, where possible, by plot experiments. This work will be supplemented by a systematic study of the work of experiment stations and experimenters along these lines of investigation. I., II.; *arrange time*; (2 to 5). Professor HOPKINS.

Required: Agronomy 12.

16. GERMAN AGRICULTURAL READINGS.— A study of the latest agricultural experiments and investigations published in the German language, special attention being given to soils and crops. The current numbers of German journals of agricultural science will be required and used as a text. This course is designed to give the student a broader knowledge of the recent advances in scientific agriculture, and, incidentally, it will aid him in making a practical application of a foreign language. It is recommended that it be taken after agronomy 12. II.; M., W.; 4; (2). Professor HOPKINS.

Required: Two years' work in German.

17. SPECIAL WORK IN FARM MECHANICS.—Students may arrange for special work in any of the lines covering drainage or farm machinery, either in second semester or the summer. ($2\frac{1}{2}$–5). Mr. CRANE.

COURSES FOR GRADUATES

101. SYSTEMS OF SOIL INVESTIGATION; SOURCES OF ERROR AND METHODS OF CONTROL, INTERPRETATION OF RESULTS. Professor HOPKINS.

102. THE WORLD'S SUPPLY OF PLANT FOOD MATERIALS, INCLUDING METHODS OF UTILIZATION. Professor HOPKINS.

103. Different Systems of Agricultural Practice and their Ultimate Effect Upon the Soil. Professor Hopkins.

104. Drainage Waters; Surface and Sub-Drainage, with Special Reference to Soil Fertility. Professor Hopkins.

105. Detailed Study of Soil Investigations in Progress in Illinois. Professor Hopkins.

106. Soil Types; Methods of Surveying and Mapping.—The work may include field practice. Mr. Mosier.

107. Erosion of Soils by Surface Washing and Methods of Prevention. Mr. Mosier.

108. The Mechanical Composition of Soils; its Influence Upon Granulation, Absorption and Retention of Moisture, and Other Physical Properties Effecting Crop Production. Mr. Mosier.

109. Experimentation in the Production of Field Crops.—The work may include actual practice in planning and conducting field experiments. Mr. Hume.

110. Weeds: Advanced Study and Investigation Relating to their Distribution, Identification, aud Methods of Eradication, and Prevention of Dissemination. Mr. Hume.

111. The Selection of Seeds; Methods of Determining Quality. Mr. Hume.

112. Plant Breeding, Including a Detailed Study of Experiments at this Station, and of Methods and Results Reported From Other States and From Foreign Countries. Mr. Smith.

113. Machine Designing; Advanced Study of Farm Implements with Special Reference to Possible Improvements. Mr. Crane.

ANIMAL HUSBANDRY

Work is constantly in progress in the various branches of animal husbandry at the Experiment Station, and ample opportunities are offered graduate students desiring to take part in these investigations. The department has well chosen representations of all the most prominent breeds of livestock, has special facility for investigations pertain-

ing to food stuffs and nutrition, and for the study of results in the production of meats. Opportunities are offered for advanced studies in various problems of breeds and breeding for which the department is supplied with the requisite literature and illustrative material. At least two years of undergraduate study in the general subject is required for major graduate work.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

7. PRINCIPLES OF STOCK FEEDING.—The functional activities of the animal body and the end products of their metabolism. Foods are considered first chemically, as affording materials for the construction of the body tissues or of animal products, as meat, milk, wool, etc.; second, dynamically, as supplying the potential energy for the body processes and for external labor; third, as to the fertilizing value of their residues. I,; *first half; daily*; 3; (2½). Professor MUMFORD.

Required: Chemistry 1, 3b, 4, 13; entrance physics or its equivalent and one year of botany or zoology.

12. BREEDS OF BEEF CATTLE.— The history, development, and characteristics of the breeds suitable for beef production. Tracing pedigrees and a critical study of the same. (This course is intended for students expecting to own or manage pure bred herds.) Lectures, assigned readings, and exhaustive practice in judging. I.; *first half; Lectures*, M., W., F., 6; *Laboratory or practical exercises in judging*, Tu., Th.; 6, 7; (2½). Professor MUMFORD.

Required: Animal Husbandry 10, 11.

14. MANAGEMENT OF PURE-BRED HERDS OF BEEF CATTLE. Like animal husbandry 3, this course is intended for students anticipating the management or ownership of registered herds, The breeding herd, and its housing, feed and management. The selection and fitting of animals for sale and for the show ring. Disposal of surplus stock. Lectures and assigned readings. I.; *second half; daily*; 6; (2½). Professor MUMFORD.

Required: Animal Husbandry 10, 11, 12, and 13.

17. THE EDUCATION AND DRIVING OF THE HORSE.—A critical study of the mental qualities, peculiarities, and limitations of the horse, together with the most successful methods of educating and training him for skillful work at labor or on the road. The rules and practices of correct driving; the responsibilities of

he driver and the courtesies of the public highway. Lectures, eadings, and practice. II.; *second half*; *daily*; 6, 7; (3).

COURSES FOR GRADUATES

101. Development of Type in Domestic Animals.—A tudy of the various factors and conditions involved in the devel- pment of type and characteristics in the breeds and strains of attle, horses, sheep and swine, and the bearing of these factors nd conditions upon future improvement. Professor Mumford.

102. Animal Nutrition,—Advanced work in the principles f nutrition as bearing upon the feeding of animals. Special in- estigations at the Experiment Station, also special study of ecords of investigations and feeding experiments of the depart- nent with reference to problems of nutrition. Professor Mumford.

103. Live Stock Experimentation. — Objects, methods, nd sources of error in experimental work dealing with the feed- ng, breeding and management of farm animals. Detailed study f live stock experiments in progress at this station, and a survey f past and present work in this line by the various experiment tations of the world. Professor Mumford.

HORTICULTURE

Exceptional facilities for the prosecution of graduate work are offered in the Department of Horticulture. A arge collection of wax models of fruits and a rapidly growing herbarium of economic and ornamental plants representing horticultural varieties as well as all the more important native and imported species furnish material for systematic work in pomology and landscape horticul- ture. This work is further facilitated by the large collec- ion of apples, flowers and ornamental plants growing upon the University grounds. Opportunity is afforded for exhaustive studies in problems concerning the pack- ng, storage and marketing of apples. Ample provision s made for research work in spraying. The greenhouses afford facilities for the study of problems in plant propaga- tion and commercial floriculture.

At least two years of collegiate work in horticulture and

allied subjects and the requisite preparation for the chosen subjects are required for entrance upon major work in this department.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

6. NURSERY METHODS.—A study of some details of nursery management and their relation to horticulture in general. Lectures and reference readings. II.; *first half; daily;* 8, (2½) Assistant Professor CRANDALL.

Required: Horticulture 1, 5; entomology 4.

7. SPRAYING.—The theory and practice of spraying plants, embracing a study of materials and methods employed in the combating of insects and fungous diseases. Recitations, reference readings, and laboratory work. II., *second half*; *Recitations*, Tu., Th.; 6; *Laboratory*, M. W., F.; 6, 7; (2½). Mr. LLOYD.

Required: Horticulture 1, entomology 4; chemistry 1.

8. ORCHADING.—A comprehensive study of pomaceous fruits: apple, pear, quince; drupaceous or stone fruits: plum, cherry, peach, nectarine, apricot. Lectures, text-books, and laboratory work. II.; *Recitations*, M. W., F.; 6.; *Laboratory*, Tu., Th.. 6, 7; (5). Professor BLAIR.

Required: Horticulture 1; botany 1 or 11.

10. LANDSCAPE GARDENING.—Ornamental and landscape gardening, with special reference to the beautifying of home surroundings. Lectures illustrated by means of lantern slides and charts, recitations, reference readings, and practical exercises. II.; M. W., F.; 4; (3). Professor BLAIR.

Required: Two years of University work, or special preparation.

12. EVOLUTION OF CULTIVATED PLANTS.—Comprising a study of organic evolution and the modification of plants by domestication. I.; *second half; daily*, 3; (2½). Assistant Professor CRANDALL.

Required: Regular admission; two years of University work, including thremmatology.

15. COMMERCIAL FLORICULTURE.—A study of the growing of cut flowers and decorative plants. Recitations and practical exercises in the greenhouse. II.; *daily;* 3. (5). Mr. BEAL.

Required: Horticulture 4, 5; botany 2.

18. EXPERIMENTAL HORTICULTURE.—A course for those intending to engage in professional horticulture or experiment

station work. For advanced students. I.; *daily;* 1; (5). Professor BLAIR, Mr. CRANDALL, Mr. LLOYD.

Required: Regular admission: twenty hours' work in horticulture.

COURSES FOR GRADUATES

101. POMOLOGY.—Studies of special problems regarding the relationships, adaptations, improvement, propagation, cultivation, pruning, protection, preservation or marketing of orchard fruits. *Arrange time.* Professor BLAIR and Assistant Professor CRANDALL.

102. POMOLOGY. — Studies of special problems regarding the adaptations, propagation, cultivation or pruning of small fruits. *Arrange time.* Assistant Professor CRANDALL.

103. OLERICULTURE.—Studies of special problems regarding the structure, cultural requirements, seed selection and improvement of vegetables. *Arrange time.* Assistant Professor LLOYD.

104. FLORICULTURE.— Studies of the horticultural status of various flowering plants, or of special problems in the culture of greenhouse plants. *Arrange time.* Mr. BEAL.

105. LANDSCAPE HORTICULTURE.—Exhaustive studies of ornamental plants, and methods of grouping the same for the effective planting of public and private grounds. *Arrange time.* Professor BLAIR.

106. FORESTRY.—Problems in general forestry and investigations of forest growths. *Arrange time.* Professor BURRILL.

THREMMATOLOGY

This work offered is primarily for graduate students, but it may be taken by undergraduates who have credit for thremmatology 1, or who have prosecuted extended studies in the problems of evolution.

COURSE FOR GRADUATES

101. Opportunity will be given for special studies in fundamental questions relating to the improvement of domesticated animals and plants. For this purpose there is available a liberal amount of current and standard literature, together with pedigree and other live stock records and the breeding experiments in progress in the Experiment Station. Professor DAVENPORT.

SUBJECTS OF THE COLLEGE OF ENGINEERING

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

Professor Ricker, Professor White, Professor Wells, Assistant Professor McLane, Assistant Professor Temple

A carefully chosen library of the most useful architectural works arranged in a room near the drawing rooms. The more important architectural periodicals in English, French and German. A very large and classified collection of photographs and plates from architectural journals for reference in designing. Card indexes to several American professional journals. Opportunities for experimental research in steel and concrete construction, heating and ventilation, refrigeration, etc., in the various laboratories of this College. Registration for graduate work requires a full undergraduate course in Architecture or Architectural Engineering.

COURSES FOR GRADUATES

101. Construction of Large Wooden Buildings.—Foundations, floors and ceilings, walls, roofs, economic spacing of columns, girders, beams.

102. New Uses of Stone, Brick, and Terra Cotta.—Stone columns, beams, lintels, walls, floors and ceiling; brick piers walls, vaulted ceilings, terra cotta columns, architraves, ceilings, roofs, and internal finish.

103. Steel Frame Buildings. — Foundations; cantilever girders; columns and their connections; girders, spandrels, and beams; roof frames; wind-bracing; economical spacing of columns and beams; economical planning.

104. Fire Proofing.—Systems of construction; their camparison; results of tests and of fires; defects to be remedied in ordinary fire-proofing; advantages of fire-proof structures as investments.

105. Sanitation of Public Buildings. — Plumbing and

fixtures; water supply and sewerage of city and country buildings; examinations, criticisms, and reports on examples; designs for particular cases.

106. Evolution of Architectural Styles.—Tracing the development of the column, pier, entablature, door and window, ceiling and roof; of designs and purposes of chief buildings; changes in decoration; influences of materials and climate.

107. Advanced Graphic Statics.—The kern and its uses; central ellipse or circle of inertia; uses of shear, moment, and deflection diagrams for all beams; statics of the arch, vault, dome, and of the Gothic buttress system.

108. Heating and Ventilating Systems.—Application to large groups of buildings; designs for large plants; examinations and tests of plants with reports; economics of the subject.

109. Advanced Architectural Designs.—Designing large buildings for public or private use, including construction, heating and ventilating, sanitation, lighting, with all conveniences to save time.

110. Applied Esthetics.—Theories of proportion and their application; study of average proportions in leading architectural styles; experiments in deviations.

111. Translation of a French or German Architectural Work.—Extraction of essentials; condensed translation; complete translation submitted for criticism and correction.

112. Indexing and Classification.— Indexing periodicals by Dewey decimal system; collection and arrangement of data for professional use; systems of arranging and filing papers and drawings.

113. Stereotomy.—Applications to arches, vaults, domes, and stairways, of stone, brick, terra cotta, or steel-concrete; working drawings and templates.

114. Slow-Burning Construction.—The factory mill-floor system; European systems; applications; results of tests of fires; economics of the systems.

115. Photography for Architects.—Practice in making views of exteriors, interiors, details, and of drawings; lantern

slides; printing by different processes; mounting and arrangement.

116. Copying Specifications and Drawings.—Practice in use of different methods; their advantages and defects; improvements; drawing and tracing for reproduction.

117. Advanced Perspective.— Study and application of higher French methods; lights and shadows; oblique views; reflections; abbreviated methods.

118. Specifications and Estimates for Large Buildings. Study of examples; making outlines; collection and arrangement of data; preparation of complete sets.

119. Industrial Design.—Internal wood-work of buildings; floors of parquetry, tiles of mosaics; marble-work; mantels; movable furniture.

120. Advanced Water Color Painting.—Practice in outdoor sketching; rendering elevations and perspectives in ink, sepia, color, etc.

121. Office Arrangements and Methods.—Plans of architects' offices; storage and drawings of completed work, filing contracts, specifications, tracings and prints of work in progress; forms of official papers; bookkeeping for buildings; collection of data for reference.

CIVIL ENGINEERING

Professor Baker.

The Cement Laboratory is well supplied with equipment for the study of problems relating to the structural value of cement and lime, and a Road Laboratory is in process of installation which will afford facilities for testing the road-building qualities of broken stone and gravel. Students in the Civil Engineering Department have opportunities for working in the Materials Testing and Hydraulic Laboratories, as well as in other laboratories of the University. For entrance to graduate work a full undergraduate course in Civil Engineering is required.

COURSES FOR GRADUATES

101. Location and Construction.— Advanced work in the economic theory of railway location with relation to the effects of distance, grade, and curve upon operation and maintenance. Estimates, specifications and contracts, and the improvement of existing lines of railway.

102. Railway Track and Structures, and Their Maintenance.—The design of track standards and of minor railroad structures, trestles, culverts, turn-tables, water-tanks, engine houses, etc., with special reference to economic principles of construction and maintenance.

103. Yards and Terminals.—The arrangement of tracks, buildings, etc., at division and terminal points with reference to economy and facility in handling traffic. Personal inspection and report on actual cases.

104. Motive Power and Rolling Stock.—Locomotive construction and performance, and car building and repairs.

105. Signal Engineering.—A study of the various systems of railway signaling. Personal inspections and comparisons of different plants in actual operation.

106. Railway Operation and Management.— The organization and administration of the several branches of service in railway operation.

107. Bridge Design.— A comparative study of the details of standard designs, with personal inspection of the process of manufacture and erection.

108. Cantilever and Swing Bridges.— The computation of stresses, design of parts, method of erection, etc.

109. Metallic Arches.—Computation of stresses and design of metallic arches.

110. Metallic Building Construction.—The computation and drawings of a design for a metal skeleton building, with a consideration of standard connections.

111. Roof Construction.— Computations of stresses and designs of steel roof stresses.

112. Stereotomy.

113. Theory of the Elastic Arch.

114. Water Power Development.

115. Re-enforced Concrete Construction.

116. Geodesy.—A study of the methods employed in triangulation, with practice in reading angles: base-line measurements. method of least squares and adjustments of triangulation systems; map projection; trigonometrical leveling.

117. Critical Description of Engineering Construction.—Details of methods and costs from personal inspection during progress of construction.

ELECTRICAL ENGINEERING

Professor Brooks, Assistant Professor Williams.

The Department of Electrical Engineering has a well-equipped laboratory containing a large variety of dynamos, motors, transformers, etc., furnishing facilities for tests upon the transmision and distribution of power. It has a particularly large and well selected cabinet of standard measuring and testing instruments. There are two photometers, and an assortment of the commercial varieties of electric lamps of all types. There is a storage battery of 60 cells, heating and welding apparatus, and an artificial transmission line for making reliable long distance transmission tests. The facilities for experimental engineering, both commercial and theoretical are excellent, and will be materially increased.

A full undergraduate course in Electrical Engineering is required for registration in graduate work.

COURSES FOR GRADUATES

101. Advanced Theory of Alternating Currents. — Discussion of the limitations of theory. Effect of minor errors of observation.

102. Dynamo Electric Machinery.— Standardization of armature windings, of design formulas, and of test methods. Study of leakage flux.

103. Alternating Current Machinery.— Transformers and their connections for single and polyphase working. Methods of compensation. The series and repulsion motor; operating efficiencies.

104. Transmission of Power.—Limiting conditions as re-

gards voltage, distance, charging current, and frequency. Types of machines. Experiments with artificial line.

105. Electric Light and Power Plants.—Economic limitations. Comparison of different designs. Determination of highest efficiency.

106. Electro-Metallurgy.—Experiments with the electric furnace. Refining of metals; recent storage batteries, and their possible improvement.

107. Electric Lighting. —Study of artistic illumination. Limitation of frequency for various types of lamps. Increased safety of wiring.

108. Electrical Engineering Research.—Problems to be assigned on consultation.

109. Electrical Design.—Standard practice. Discussion of improvements.

110. Telephone Engineering.—Standardization of apparatus. Switchboard design. Line testing. Methods for increasing efficiency and possible distance. Cables.

111. Telegraph Engineering.—Study of commercial conditions. Determination of best method or rapid machine-transmission. Simultaneous telegraphy and telephony. Wireless telegraphy in relation to ordinary telegraphy, and in regard to improvements.

MECHANICAL ENGINEERING

Professor Breckenridge, Assistant Professor Goodenough, Assistant Professor Leutwiler, Assistant Professor Randall.

The equipment available for experimental investigation in the Department of Mechanical Engineering is most complete along the following lines:

1. Boiler tests with various types of furnace and stokers.

2. The generation of power with engines of different types and at various steam pressures up to 275 lb.

3. The use of steam for heating from a central station, loss of pressure, and heat by transmission through long mains.

4. The generation, transmission and use of compressed air.

5. The generation of power by small gas or gasoline motors, including the testing of automobile vehicles.

6. Mechanical refrigeration.—There are three plants available for testing and examinination.

7. Locomotive road testing and train resistance tests.—For this work the department owns with the Illinois Central Railroad a fully equipped railway test car.

8. The measurement of power required to operate machine tools and woodworking machinery.—This includes tests relating to the performance of various tools and the comparison of different kinds of tool steel.

The construction of a new Steam Engineering Laboratory, for the equipment of which a generous appropriation has been made, will greatly increase the space and facilities of the department for experimentation.

A complete equipment will be added for experiments in the subject of heating and ventilation, as well as for the production of superheated steam.

Arrangements have been made with the management of the Peoria & Eastern Railway shops at Urbana for carrying on many tests and investigations on a commercial scale, not usually possible in a school laboratory, and much valuable aid is assured the department by the officers of this company. These shops are new, extensive and modern in all respects. There is required a full undergraduate course in Mechanical Engineering for entrance upon graduate work.

COURSES FOR GRADUATES

101. Advanced Machine Design.—The work offered in machine design will be arranged to suit individual students. It covers a wide field and may include all forms of motors as well as usual and special machinery.

102. Graphics and Kinematics.—The application of graphical dynamics, especially to governors. A study of acceleration in mechanisms, using Coriolis' law as a basis.

103. Mill Engineering.— Transmission of power; design and installation of power plants.

104. Steam Engineering.—Critical study of superheating, jacketing, compounding; steam turbines: the generation of steam.

105. Experimental Engineering.—Tests of engines, boilers, air compressors, power plants, pumping plants, etc.

106. Thermodynamics.—Reading of advanced texts, as Parker's or Buckingham's. Critical study of cycles, both direct and reversed. Solution of numerous problems.

107. Pneumatics.— Air compression; transmission of air through pipes; theory and design of centrifugal fans and blowers; blowing engines.

108. Hydraulic Machinery.—Pumps and pumping engines; centrifugal and rotary pumps; hydraulic presses, punches, cranes, etc.; hydraulic elevators; hydraulic transmission.

109. Machinery and Manufacturing.—Shop construction and methods; cost-keeping systems; automatic machinery and interchangeable parts; adaptation of special machinery to the various industries.

110. Translation of Technical Engineering Literature.—Under this head is included the translation of engineering books and also of important articles appearing in Zeitschrift des Vereines Deutscher Ingeneur, Revue de Mècanique, etc.

111. Heat Engines and Gas Engineering.— The various heat engine cycles; temperature-entropy analysis applied to heat engines; engines with two or more fluids; general theory of the gas engine; gas producers; gaseous fuels.

112. Locomotive Engineering.—Study of the design and constructing of locomotives; counterbalancing; road tests of locomotives.

113. Mechanical Refrigeration.—Thermodynamic theory of refrigeration; properties of refrigerating fluids. Study of ice and refrigeration plants.

114. Motor Vehicles.—The various types of automobiles.

115. Indexing and Classification of Engineering Literature.

MECHANICS, THEORETICAL AND APPLIED

Professor TALBOT.

The Laboratory of Applied Mechanics with its well-arranged building, numerous testing machines of various types for making tension, compression, cross-bending, and torsion tests of structural materials, the special facilities for testing paving brick, and its commodious hydraulic laboratory well fitted with tanks, piping, channels, pumps, motors and measuring devices, offers exceptional facilities for investigational work. New equipment is to be added, including a 500,000 lb. testing machine.

COURSES FOR GRADUATES

101. ANALYTICAL MECHANICS.—Studies of advanced texts; comparisons of texts and methods and presentation for an elementary course.

102. RESISTANCE OF MATERIALS.—Study of the properties of structural materials, of the methods of testing for these properties, and of the determination of internal stresses.

103. HYDRAULICS AND HYDRAULIC ENGINEERING. — Advanced work in hydraulics.

104. LABORATORY OF APPLIED MECHANICS.—Investigational work either in the materials testing laboratory or in the hydraulic laboratory.

MUNICIPAL AND SANITARY ENGINEERING

Professor TALBOT, Mr. SLOCUM

The University water works and the hydraulic laboratory, as well as the bacteriological and chemical laboratories, offer advantages to the student in water supply engineering and sewerage, and near-by cities give opportunities for a study of water filtration and sewage disposal plants.

COURSES FOR GRADUATES

101. TANKS, STANDPIPES AND RESERVOIRS.— Design and methods of construction of these structures. Especial attention to the cause of failure of standpipes and to requirements for safe construction. Study of plans of existing structures and of methods of construction employed.

102. Sources and Requirements of Water Supply for a City and Removal of Impurities.—A study of the various sources of supply and of their development, of methods of filtration, and of the design and operation of filtered plants.

103. Water Works Management and Economics.—Water works records; revenue, operation, management, franchises and their relation to the public, with a study of existing plants.

104. Pumps and Pumping.—Types of pump; design, construction, operation, duty and efficiency; applicability of different types; duty trials and tests.

105. General Water Works Construction.—When practicable a discussion will be made of plans, methods, and construction of work with which the student has been connected.

106. Biological and Chemical Examination of Potable Water.—This will be given in connection with the departments of botany and chemistry.

107. Description of Water Supply Systems.—Critical discussion of water-works systems from personal observation made during construction and upon the operation of similar plants.

111. Sewage Purification.—A study of the processes and methods in use, of the results obtained, and of the requirements and needs of sewage disposal.

112. Sewage Disposal Works.—The design and methods of construction of various forms of purification plants and of their applicability and efficiency.

113. General Sewerage Design and Construction.—This usually involves the actual work of designing and participating in the work of construction of systems of sewers.

114. City Sanitation.—Methods and processes of garbage collection, reduction and disposal; sanitary restrictions and health measures.

115. Description of Sewerage Systems.—Critical examination and description from personal observations made during construction and upon the operation of sewerage systems.

118. Economic Aspect of Good Roads and Pavements.—An investigation of the value of road improvements.

119. Construction of Roads and Pavements.—Tests and requirements of meterials. Specifications. Comparison of cost, desirability and durability. Grades and location.

SOCIETIES AND CLUBS

CLUBS AUXILIARY TO COURSES OF STUDY

Agricultural Club

This club meets weekly. It is devoted to the discussion of topics of theoretical and practical interest to students of agriculture. All students connected with the University are eligible to membership.

Architects' Club

This club meets once in two weeks for the consideration of current topics of architectural interest and subjects connected with the study of architectural history. All students pursuing architectural studies are eligible to membership. This club is a member of the Architectural League of America, and contributes to its annual exhibition in the principal cities of the United States.

Biological Theory Club

This club meets on alternate Monday evenings throughout the college year for papers, addresses, and discussions on subjects in theoretical biology. Its membership is composed of instructors in biological subjects in the Colleges of Science and Agriculture.

Civil Engineering Club

This club meets the second and fourth Saturday evenings of each month for the reading and discussion of papers relating to civil engineering. All students pursuing the civil engineering course may become members.

The English Club

The English Club is composed of members of the Faculty, and of students who have done especially good work in English. The work of the club is confined to the study

of recent writers of fiction and of poetry. The membership is limited to thirty. Meetings are held on the second Monday of each month.

French Club

Le Cercle Francais includes students who have had at least one year's work in French. The club meets twice a month throughout the year. Its proceedings are conducted in French, the object being to supplement the work of the class room by the practical handling and understanding of the language.

Library Club

The instructors and students of the Library School have organized a Library Club. Any member of the staff of the University library, of the Champaign public library, or of the Urbana public library, or any student who is registered for the Library School may become an active member. Trustees of the three libraries before mentioned are considered honorary members. Any others interested in library progress may become associate members.

Meetings are held once in three weeks during the college year. The first and last meetings of the year are of a social nature. The intervening meetings are devoted to topics of literary or technical library interest.

Mathematical Club

The Mathematical Club is open for membership to the instructors and students of mathematics at the University. It meets once in two weeks to discuss questions of interest in pure and applied mathematics.

Mechanical and Electrical Engineering Society.

This club meets on the second and fourth Friday evenings of each month. All students pursuing mechanical and electrical engineering studies are eligible to membership. Papers relating to subjects of interest to members are presented and discussed at each meeting.

Musical Clubs

These include the Choral Society, Orchestra, Band, and Mandolin and Guitar, and two Glee Clubs.

The Natural History Society

This society is composed of instructors and students interested in the natural sciences. It conducts field excursions and exhibitions of objects of natural history, and provides occasional lectures on science subjects of general interest.

Political Science Club

This club is composed of the members of the corps of instruction in history, economics and law, and of such students of at least junior and senior standing as make a record for marked excellence in work in these departments. It meets once a month.

Zoological Club

The University Zoological Club is composed of advanced students and instructors in the zoological and physiological departments, together with such other biological instructors and advanced students as are interested in its subjects. Its sessions are devoted to the presentation and discussion of abstracts of recent biological literature and of the results of investigation by the members of the club. It meets weekly in Natural History Hall.

Literary Societies

The Adelphic and Philomathean societies for men, and the Alethenai for women, occupy large halls, which the members have appropriately furnished and decorated. Meetings are held Friday evenings throughout term time.

THE CHRISTIAN ASSOCIATIONS

Young Men's and Young Women's Christian Associations

The Young Men's and Young Women's Christian Associations have come to occupy a prominent place in the University life. Both are affiliated with the World's Stu-

dent Christian Federation, which is the largest student organization in existence.

Five hundred and fifteen men now belong to the Young Men's, and three hundred women to the Young Women's, Association. Each association employs for full time a general secretary.

The Association House furnishes free to all students, reading room, game room, library, parlors, piano, magazines and papers, correspondence tables and telephone—a college home.

Religious meetings for men are held on Sunday mornings; for women on Thursday afternoons; and for both men and women on Monday evenings. There are frequent meetings for the promotion of social intercourse and good fellowship.

Courses in systematic Bible study and in modern missions are offered. During the year four hundred and twenty-nine men and two hundred women have enrolled in these courses. A most helpful feature of the work is that in the interest of new students at the opening of the school year. Desirable rooms and boarding places are found and posted for reference as the Association House. Representatives of the Associations meet the trains, assist students in finding satisfactory locations, and endeavor in every way to make them feel at home. The employment bureau helps to find work.

A copy of the Students' Hand-Book, containing a map of the cities, and giving information about Champaign and Urbana, the University, and the various college organizations and activities, will be sent free to prospective students.

For further information address the General Secretary of either Association, Champaign.

EXPENSES

BOARD

The University does not furnish board, but there are a large number of suitable places within easy walking distance of the University or readily accessible by electric railway where students can find table board at from $3.00 to $3.50 per week each, and rooms (suitable for two) at about $36.00 to $54.00 for a semester of 18 weeks.

The Young Men's and Young Woman's Christian Associations aid new students in procuring rooms and boarding places.

FEES

The fees for members of the Graduate School are the same as for undergraduate students of the Colleges of Literature and Arts, Agriculture, and Engineering as follows:

Matriculation, payable upon entrance	$10.00
Diploma, payable before degree is awarded	5.00
Incidental, each semester	12.00
Laboratory, actual expenses, deposits	50c to 10.00

LIST OF STUDENTS

GRADUATE SCHOOL

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

*Crocker, William, A. M., 1903, *DeKalb*, Botany.
Day, Edna Daisy, M. S., (*Univ. of Mich.*), 1897, *Urbana*, Botany.
Dewey, James Ansel, M. S., 1898, *Urbana*, Bacteriology.
Gleason, Henry Allen, B. S., 1901, *Champaign*, Botany.
Heuse, Edward Otto, B. S. (*Hanover, Coll.*), 1900, *Madison, Ind.*, Chemistry.
Latzer, Jennie Mary, M. S., 1900, *Highland*, Botany.
Matson, George Charleton, A. M., (*Cornell Univ.*), 1903, *Champaign*, Geology.
Miller, John Ezra, A. M., 1902, *Urbana*, Latin.
Pillsbury, Bertha Marion, A. M., (*Radcliffe College*), 1899, English.
Ponzer, Ernest William, M. S., 1903, *Champaign*, Mathematics.
Reeves, George I., A. B., 1902, *Wauponsee*, Zoology.
*Ross, Luther Sherman, M. S., 1900, *Des Moines, Ia.*, Zoology.
Sakagami, Yasuzo, M. L., (*Univ. of Minn.*), 1899, *Wakagamaken, Japan*, Political Science.
Sammis, John Langley, M. S. 1899, *Champaign*, Chemistry.
Schulz, William Frederick, E. E., 1900, *Urbana*, Physics.
Zartman, Lester William, A. B., 1903, *Grant Park*, Economics.

CANDIDATES FOR THE MASTER'S DEGREE

Anderson, Mary, A. B., 1903, *Macon*, Mathematics.
Barrett, James Theophilus, A B., 1903, *Urbana*. Botany.
Black, Alice Mary, A. B., 1900, *Champaign*, Latin.
*Bond, Anna Louise, A. B., 1903, *Mt. Vernon*, English.
*Booker, Lucile Alice, A. B., 1899, *Stillwater, Minn.*, English.
Briscoe, Charley Francis, A. B., (*Indiana State Univ.*), 1899, *Urbana*, Botany.
*Bullock, Jessie Jane, A. B., 1900, *Champaign*, Mathematics.
*Church, Walter Samuel, B. S., 1900, *Chicago*, Architecture.
*Clark, Mary Edith, A. B., 1899, *Sheldon*, Philosophy.

*In absentia. See page 29.

Clarke, Samuel C., B. S., (*Univ. of Chicago*), 1900, *Urbana*, Chemistry.

*Clarke, Edwin Besancon, B. S., 1891, *Chicago*, Architecture.

‡Collis, Frank Bernard, B. S., 1902, *Norwich, Conn.*, Mechanical Engineering.

Crosthwait, George Ashley, B. S., 1903, *Moscow, Idaho*, Agronomy.

Crane, Fred Randall, B. S., (*Mich, Agr'l Coll.*), 1899, *Urbana*, Agronomy.

Dickerson, Oliver Morton, A. B. 1903, *West Liberty*, History.

Dillon, Gertrude Sempill, A. B. 1901, *Sheldon*, German.

East, Edward Murray, B. S., 1901, *Champaign*, Agronomy.

Emmett, Arthur Donaldson, B. S., 1901, *Urbana*, Chemistry.

Falkenberg, Fred Peter, A. B., 1902, *Chicago*, English.

Fox, Harry Bert, B. S., 1900, *Urbana*, Geology.

Franklin, Lois Gertrude, A. B., 1903, *Dwight*, History.

Fritter, Enoch Abraham, A. M., (*Findlay Coll.*) 1898, *Normal*, English.

*Fucik, Edward James, B. S., 1901, *Chicago*, Civil Engineering.

*Gallaher, Thomas Theron, A. B., 1902, *Byron*, Philosophy.

Garlough, Carl D, A. M., (*Hillsdale, Coll.*), 1900, *Stanford*, Mathematics.

Gilkerson, Frances Emeline, A. B., 1903, *Urbana*, German.

*Greenman. Edwin Gardner, Jr., B. S., 1902, *Champaign*, Mechanical Engineering.

*Grimes, George Lyman, B. S., 1897, *Kewanee*, Mechanical Engineering.

Harris, Thomas Luther, A. B., 1902, *Modesto*, Economics.

Hayhurst, Emery Roe, A. B., 1903, *Maywood*, Physiology.

*Heath, Lawrence Seymour, A. B. 1901, *Edinburg*, Latin.

*Hicks, Byron Wallace, B. S., 1901, *Warren*, Civil Engineering.

*Higgins, Francis Whitson, B. S., 1902, *Niagara Falls, N. Y.* Chemistry.

Hoff, Edna DuBois, A. B., 1903, *Chicago Heights*, Chemistry.

*Hoppin, Charles Albert, B. S., 1901, *Milwaukee, Wis.*, Mechanical Engineering.

Horner, Harlan Hoyt, A. B., 1901, *Urbana*, English.

Hughes, Clarence Wilbert, A. B., 1900, *Urbana*, History.

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‡Died, November 5, 1903.

Ingels, Bert Dee, B. S., (*DePauw Univ.*), 1903, *Greencastle, Ind.*, Chemistry.

*Ireland, Washington Parker, B. S., 1903, *Chicago*, Civil Engineering.

*Johnson, Frederick Dawson, B. S., 1903, *Alton*, Mechanical Engineering.

*Johnson, Fred Vollentine, B. S. 1902, *Harvey*, Mechanical Engineering.

Jones, Warren, A. B., 1902, *Aurora*, Eduation.

Kelley, Frances Emily, A. B., 1901, *St. David*, German.

*Kofoid, Reuben Nelson, A. B., 1902, *Buffalo, N. Y.*, Chemistry.

Lafferty, Guy Clifford, A. B., (*Monmouth, Coll.*), 1903, *Alexis*, Economics.

Larson, Lawrence Fred, A. B. 1903, *Galva*, Economics.

*Layton, Katherine Alberta, A. B., 1901, *Canton*, German.

Lytle, Ernest Barnes, B. S., 1901, *Urbana*, Mathematics.

*McConnell, Ernest, B. S., 1894, *Denver, Colo.*, Architecture.

*McLane, John Wallace, B. S., 1901, *Washington, D. C.*, Agronomy.

Malcolm, Charles Wesley, B. S., 1902, *Roseville*, Civil Engineering.

*Martin, Albert Carey, B. S., 1902, *LaSalle*, Architecture.

Matthews, Robert Clayton, B. S., 1902, *Champaign*, Mechanical Engineering.

*Mayall, Edwin Lyman, B. S., 1900, *Peoria*, Mechanical Engineering.

Miller, Harry Crawford, A. B. (*Austin, Coll.*), 1893, *Nokomis*, Education.

Moor, Rev. George Caleb, Ph. D., (*Ewing, Coll.*), 1899, *Champaign*, English.

*O'Hair, Elizabeth Edna, A. B., 1901, *Laurel, Ind.*, Latin.

Parker, Lawrence Gilbert, B. S., 1902, *Toluca*, Civil Engineering.

*Parr, Robert William, A. B., 1903, *Pontiac*, Economics.

Ponzer, Ernest William, B. S., 1900, *Champaign*, Mathematics.

*Radcliffe, William Hickman, B. S., 1901, *Chicago*, Civil Engineering.

Randall, Dwight T. B. S., 1897, *Urbana*, Mechanical Engineering.

*Richard, Frederick William, B. S., 1891, *Carterville,* Mechanical Engineering.

Rolfe, Martha Deette, B. S., 1900. *Champaign*, Zoology.

Rolfe, Mary Annette, A. B., 1902, *Champaign*, Zoology.

*Sawyer, Geogre Loyal, B. S., 1903, *Chicago*, Municipal and Sanitary Engineering.

*Scudder, Harry Disbro, B. S., 1902, *Chicago*, Horticulture.

*Skinner, Elgie Ray, B. S., 1903, *Chicago*, Mechanical Engineering.

Slocum, Roy Harley, B. S., 1900, *Urbana*, Municipal and Sanitary Engineering.

*Smith, Bruce, A. B., 1901, *Newman*, English.

*Smith, Florence Mary, A. B., 1899, *Urbana*, English.

Smith, Fred John, A. B., (*Iowa Wesleyan University*), 1899, *San Jose*, German.

*Smith, George Russell, B. S., 1900, *Urbana*. Mechanical Engineering.

*Smith, Percy Almerin, B. S., 1901, *Hiroshima, Japan*, Mathematics and Physics.

*Soverhill, Harvey Allen, B. S., 1900, *Beloit, Wis.*, Mechanical Engineering.

*Sperling, Godfrey, B. S., 1895, *Boise, Idaho*, Civil Engineering.

*Stine, John Carl, A. B., 1903, *Assumption*, Education.

*Strehlow, Oscar Emil, B. S., 1895, *Tuscaloosa, Ala.*, Civil Engineering.

*Sussex, James Wolfe, B. S., 1903, *Abingdon*, Civil Engineering.

*Swanberg, Floyd Ludwig, B. S., 1902, *Danville,* Mechanical Engineering.

*Sweeney, Don, B. S., 1896, *Galesburg*, Mechanical Engineering.

Taylor, Helen Mary, A. B., 1902, *Bloomington*, English.

*Terry, Charles Dutton, B. S., 1897, *Kewanee*, Mechanical Engineering.

*Tower, Willis Eugene, B. S., 1894, *Chicago*, Physics.

*Tull, Effie May, A. B., 1901, *Farmer City*, Latin.

Waterbury, Leslie Abram, B. S., 1902, *Urbana*, Civil Engineering.

Webber, Roy Irvin, B. S., (*Purdue Univ.*), 1899, *Urbana*, Civil Engineering.

Wells, Miriam Ursula, A B., 1903, *Malden*, Zoology.

Western, Irving Mark, A. B., 1902, *Dundee*, Rhetoric.

*Whitehouse, Edith Ursula, A. B., 1902, *Canton*, Latin.
*Whitmeyer, Mark Halbert B. S., 1899, *Danville*, Architecture.
Whitsit, Hammond William, B. S., 1903, *Urbana*, Architecture.
*Wilcox, Maurice Meacham, B. S., 1899, *Kentwood, La.*, Civil Engineering.
Williams, Winifred Sue, A. B., 1901, *Urbana*, German.
Willis, Clifford, B. S., 1900, *Urbana*, Agronomy.
Wilson, Joseph Wade, B. S., 1903, *Chicago*, Architecture.
*Wright, Sidney Walter, A. B., 1901, *Mechanicsburgh*, History.
*Wood, Harvey Edgerton, A. B., 1900, *Joliet*, Economics.
Young, Sadie, B. S., (*Univ. of Fla.*), 1902, *Lake City, Fla.*, English.

NOT CANDIDATES FOR A DEGREE

Calhoun, Henrietta Anne, A. M., 1903, *Champaign*, Physiology.
Fox, Fred Gates, A. M., 1903, *Urbana*, English.
Lefler, Emma Grace, B. L. S., 1903, *Pontiac*, English.
Lloyd, John William, M. S. A., (*Cornell Univ.*), 1903, *Champaign*, Botany.
Zangerle, Arthur Norman, B. S., 1903, *Chicago*, Chemistry.

SUMMARY OF STUDENTS—1903-1904

		Men.	*Women.*	*Total.*
GRADUATE SCHOOL		94	26	120
UNDER GRADUATE COLLEGES—				
Seniors	170	104	274	
Juniors	186	72	258	
Sophomores	388	87	375	
Freshmen	439	134	573	
Specials	196	106	302	
	—	1279 —	503 —	1782
SPECIALS IN AGRICULTURE		133	1	134
SPECIALS IN HOUSEHOLD SCIENCE			14	14
SUMMER TERM		137	92	229
COLLEGE OF LAW—				
Third year	36		36	
Second year	27		27	
First year	52		52	
Specials	27		27	
	—	142	—	142
COLLEGE OF MEDICINE—				
Seniors	227	18	245	
Juniors	178	12	190	
Sophomores	132	11	143	
Freshmen	85	9	94	
Unclassified	19	3	22	
	—	641 —	53 —	694
COLLEGE OF DENTISTRY—				
Seniors	56	3	59	
Juniors	64	1	65	
Freshmen	39		39	
	—	159 —	4 —	163
SCHOOL OF PHARMACY—				
Seniors	68		68	
Juniors	116	1	117	
	—	184 —	1 —	185
ACADEMY		189	68	257
		2958	762	3720
Deduct counted twice		80	44	124
Total in University		2878	718	3596

1904-05

UNIVERSITY OF ILLINOIS BULLETIN

Vol. 1 JUNE 15, 1904 No. 18

[Entered at Urbana, Illinois, as second-class matter]

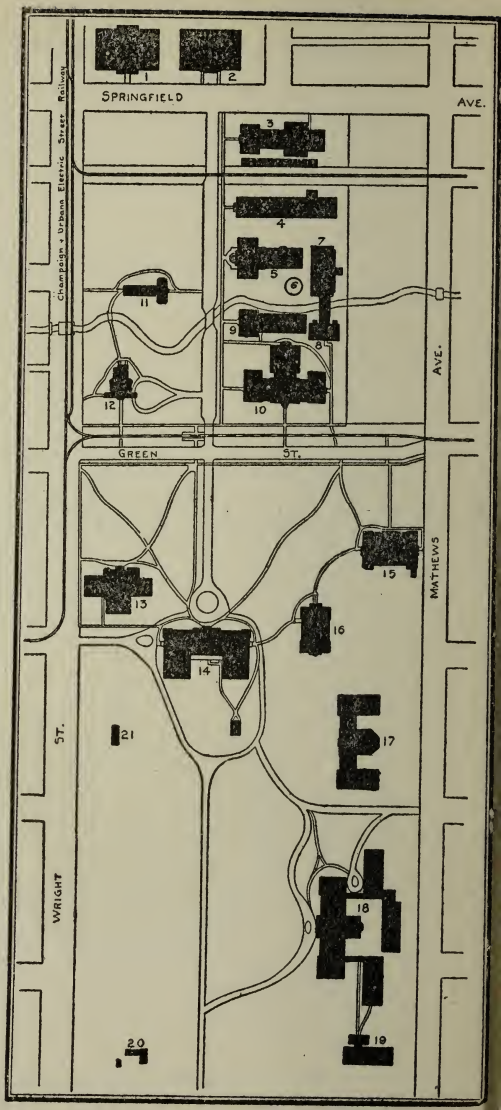
GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

PUBLISHED FORTNIGHTLY BY THE UNIVERSITY

1. Men's Gymnasium.
2. Armory.
3. Wood Shop.
4. Metal Shops.
5. Electrical and Mechanical Laboratory.
6. Reservoir.
7. Heating Plant.
8. Pumping Plant.
9. Laboratory of Applied Mechanics.
10. Engineering Hall.
11. Greenhouse.
12. President's House.
13. Library.
14. University Hall.
15. Natural History Hall.
16. College of Law.
17. Chemical Laboratory.
18. Agricultural Buildings.
19. Greenhouse.
20. Veterinary Building.
21. Insectary.



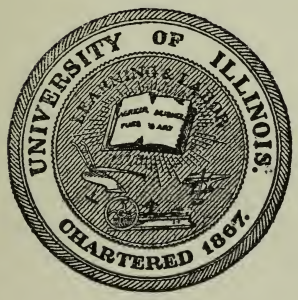
UNIVERSITY GROUNDS AND BUILDINGS

GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1904-1905



URBANA, ILLINOIS
PUBLISHED BY THE UNIVERSITY

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1904/05

TABLE OF CONTENTS

Calendar 4
Board of Trustees 6
Officers of Administration 7
Heads of Departments 9
Location and History 11
Organization of the University 12
Buildings and Grounds 15
Laboratories and Collections 16
History of the Graduate School 24
Admission and Registration 25
Studies and Examinations 27
Degrees 29
Fellowships 31
Courses of Study 33
Subjects of the College of Literature and Arts . . 34
Subjects of the College of Science 50
Subjects of the College of Agriculture 68
Subjects of the College of Engineering 76
Societies and Clubs 86
Expenses 90

THE UNIVERSITY CALENDAR

1904-1905

1904	FIRST SEMESTER
Sept. 7, Wednesday.	Entrance Examinations begin.
Sept. 12, 13, Monday and Tuesday.	Registration Days.
Sept. 14, Wednesday.	Instruction begins.
Oct. 31, Monday.	Latest date for announcing Subjects of Theses.
Nov. 24, Thursday.	Thanksgiving Day.
Dec. 21, Wednesday.	Holiday Recess begins.
1905.	
Jan. 3, Tuesday.	Instruction resumed.
Jan. 27, Friday.	First Semester ends.
	SECOND SEMESTER
Jan. 30, Monday.	Instruction begins.
May 11, 12, Thursday and Friday.	University High School Conference.
May 12, Friday evening.	Interscholastic Oratorical Contest.
May 11, 12, 13, Thursday to Saturday.	Public School Art Exhibit.
May 13, Saturday.	Interscholastic Athletic Meet.
May 22, Monday.	Hazelton Prize Drill. Company Competitive Drill.
May 26, Friday.	Latest Day for Acceptance of Theses.
June 4, Sunday.	Baccalaureate Address.
June 5, Monday.	Class Day.
June 6, Tuesday.	Alumni Day.
June 7, Wednesday.	Thirty-fourth Annual Commencement.

FIRST SEMESTER

Sept. 13, Wednesday.	Entrance Examinations begin.
Sept. 18, 19, Monday and Tuesday.	Registration Days.
Sept. 20, Wednesday.	Instruction begins.
Nov. 6, Monday.	Latest date for Announcing Subjects of Theses.
Nov. 30, Thursday.	Thanksgiving Day.
Dec. 15, Friday.	Holiday Recess begins.
1906.	
Jan. 2, Tuesday.	Instruction resumed.
Jan. 26, Friday.	First Semester Ends.

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1101 West Oregon Street, U.

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*U. stands for Urbana, C. for Champaign.

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HARRY SANDS GRINDLEY, Sc.D., Associate Professor of Chemistry. *918 West Green Street, U.*

LOCATION AND HISTORY

LOCATION

The University of Illinois is situated in Champaign County, in the eastern central part of the state, between the cities of Urbana and Champaign, and within the corporate limits of the former. It is one hundred and twenty-eight miles south of Chicago, at the junction of the Illinois Central, the Cleveland, Cincinnati, Chicago and St. Louis, and the Wabash railroads. The country around is a rich and prosperous agricultural region. The cities of Urbana and Champaign have, together, a population of about 17,000.

HISTORY

The University was incorporated February 28, 1867, under the name of the Illinois Industrial University, and was opened to students March 21, 1868. At first only men were received, but on March 9, 1870, women were also admitted. The institution is in part endowed by the national government, and is maintained by the State of Illinois. The present value of property is estimated at $2,600,000. In 1885 the state legislature changed the name to the University of Illinois. In the same year also, by act of the legislature, the *State Laboratory of Natural History* was transferred from the Illinois State Normal University. The *Agricultural Experiment Station*, founded upon an annual congressional donation, was established in 1887. The *Graduate School* dates from 1892. May 1, 1896, the Chicago College of Pharmacy, located at 465 State street, Chicago, became the *School of Pharmacy of the University of Illinois.* A *School of Law* organized in 1897 became the *College of Law* in

1900. The College of Physicians and Surgeons of Chicago, Corner Congress and Honore Streets, became, April 21, 1897, the *College of Medicine of the University of Illinois;* the instruction in music was reorganized and the *School of Music* was established, and the *State Library School* was opened in September of that year. The *School* (now *Colleye*) *of Dentistry*, Corner of Harrison and Honore Streets, Chicago, was opened October 3, 1901.

The corps of instruction for the year 1903-1904, not counting administrative officers, includes 101 professors, 42 associate professors, 41 assistant professors and 136 instructors and assistants. The total number of students for the same year is 3594, of whom 2876 are men and 718 women. 2552 are connected with the departments in Urbana, and 1042 in Chicago.

ORGANIZATION OF THE UNIVERSITY

For the purpose of more efficient administration, the University is divided into several colleges and schools. This division does not imply that the colleges and schools are educationally separate. They are interdependent, and together form a unit. In addition to the courses mentioned as given in each college and school, instruction in military science and physical training is provided. The organization is as follows:

I. The College of Literature and Arts.
II. The College of Engineering.
III. The College of Science.
IV. The College of Agriculture.
V. The Graduate School.
VI. The School of Library Science.
VII. The School of Music.
VIII. The College of Law.
IX. The College of Medicine.
X. The School of Pharmacy.
XI. The College of Dentistry.

THE COLLEGE OF LITERATURE AND ARTS

The College of Literature and Arts offers a wide range of subjects in philosophy and the arts, including:

1. The ancient classical languages.
2. English literature and language, including rhetoric.
3. The Romanic languages, including French, Italian and Spanish.
4. The Germanic languages, including German, Scandinavian and Danish.
5. The political and social sciences, including history, economics, sociology, anthropology, and science of government.
6. Courses of training for business.
7. Philosophical subjects, including philosophy, mathematics, psychology, education, and ethics.
8. Courses in library science, consisting of three years' college work, followed by the first year in the School of Library Science.

THE COLLEGE OF ENGINEERING

The College of Engineering offers courses—

1. In Architecture.
2. In Architectural Engineering.
3. In Civil Engineering.
4. In Electrical Engineering.
5. In Mechanical Engineering.
6. In Municipal and Sanitary Engineering.
7. In Railway Engineering.

THE COLLEGE OF SCIENCE

The College of Science offers courses in—

1. General Science.
2. Chemistry.
3. Education.
4. Household Science.
5. Library Science.
6. Mathematics.
7. Physics.
8. Studies Preliminary to Medicine.

COLLEGE OF AGRICULTURE

The College of Agriculture offers courses in—

1. Agronomy.
2. Animal Husbandry.
3. Dairy Husbandry.
4. Horticulture.
5. Household Science.
6. Veterinary Science.

THE GRADUATE SCHOOL

The Graduate School offers courses in twenty-seven distinct subjects, as follows: agronomy, animal husbandry, architecture, botany, chemistry, civil engineering, economics, education, electrical engineering, English language and literature, French, geology, German, Greek, history, horticulture, household science, Latin, mathematics, mechanical engineering, municipal and sanitary engineering, philosophy, physics, physiology, psychology, thremmatology, and zoology.

The courses of instruction under these subjects are hereafter described.

THE SCHOOL OF LIBRARY SCIENCE

The School of Library Science, or the State Library School, offers a course of study extending over five years, three of which are in either the College of Literature and Arts or the College of Science. The last two years are devoted to courses in library science in the Library School. The full course leads to the degree of bachelor of library science.

THE SCHOOL OF MUSIC

The School of Music offers courses in vocal and instrumental music, leading to the degree of bachelor of music.

THE COLLEGE OF LAW

The College of Law offers a course of study leading to the degree of bachelor of laws.

THE COLLEGE OF MEDICINE

The College of Medicine offers a course of study leading to the degree of doctor of medicine.

THE SCHOOL OF PHARMACY

The School of Pharmacy offers a course in all branches necessary to a complete scientific and practical knowledge of pharmacy, including pharmacy, chemistry, materia med ica, botany, physics, and physiology. The course leads to the degree of graduate in pharmacy.

THE COLLEGE OF DENTISTRY

The College of Dentistry offers a course leading to the degree of doctor of dental surgery.

BUILDINGS AND GROUNDS

The land occupied by the University embraces about 220 acres. The campus is roomy and presents a very attractive appearance. The main buildings, 20 in number, include the *Library Building* containing stack-room space for 150,000 books, reading rooms, seminary rooms, administrative offices and quarters for the Library School; *University Hall*, a large structure of four main floors containing the administrative offices and class rooms of the College of Literature and Arts and the rooms of the School of Music; the *Law Building* in which are the offices, lecture rooms, moot court room, library, etc., of the College of Law; *Natural History Hall* in which are housed the departments of botany, zoology, physiology, and geology and the apartments of the State Laboratory of Natural History; the *Astronomical Observatory*; the *Chemical Laboratory* of three stories with a large lecture room, a number of large and several small laboratory apartments, supply room, offices, etc.; the *Agricultural Building* of four independent structures

built around an open court providing rooms for the administrative offices of the College and of the Agricultural Experiment Station, and for the departments of agronomy, animal husbandry, dairy husbandry, horticulture, veterinary science and household science; the *Engineering Hall* of four stories devoted to the offices, class rooms, drawing rooms, laboratories, etc., of the departments of architecture, civil, electrical, mechanical and municipal engineering and of physics; the *Wood Shop*, for instruction and practice with wood working tools and machines; the *Metal Shops* for work with metal working tools and machines; the *Mechanical and Electrical Engineering Laboratory*; the *Laboratory of Applied Mechanics*; the *Central Heating Station*; the *Pumping Station* from which the University is abundantly supplied with water; the *Armory* having one grand hall 100 by 150 feet; the *Men's Gymnasium*,—a three-story structure providing all the facilities of a modern gymnasium; and the *President's House.* A *Woman's Building* is in course of construction. The buildings for the Colleges of Medicine and of Dentistry and for the School of Pharmacy are in Chicago, and furnish excellent quarters for these important organizations.

LABORATORIES AND COLLECTIONS

SCIENCE LABORATORIES

The *botanical*, *geological*, *physiological*, and *zoological laboratories* are in Natural History Hall.

The *chemical laboratory* occupies the building of the same name, already described.

The *physical laboratory* is in Engineering Hall. It is provided with piers, a constant temperature room, and other conveniences for measurement work.

The *psychological laboratory*, in University Hall, is well

provided with apparatus of many different kinds for use in experimental study, research, and instruction.

A *laboratory of economic geology*, for the investigation of clays, lime and cement-making materials, building stones, road metal, and all other mineral substances of economic value, has been equipped with the necessary appliances for such investigations.

ENGINEERING LABORATORIES

The *cement laboratory* of the department of civil engineering occupies rooms in Engineering Hall.

The *electrical engineering laboratory* occupies space on three floors of the Mechanical and Electrical Engineering Laboratory.

The *mechanical engineering laboratory* occupies the rear wing of the Mechanical and Electrical Engineering Laboratory.

The *hydraulic laboratory* and the *materials testing laboratory* occupy the Laboratory of Applied Mechanics.

SPECIAL LABORATORIES FOR RESEARCH

The *chemical laboratory of the Agricultural Experiment Station* and the *student laboratory* for the study of fertility of soils are situated on the third floor of the Agricultural Building, as are also the *bacteriological laboratory* and the *physical laboratory* for the examination of soils.

The *materials* and *hydraulic laboratories* occupy the new Laboratory of Applied Mechanics.

The laboratory rooms of the *State Laboratory of Natural History* are in Natural History Hall.

A *Biological Station*, equipped for field and experimental work in aquatic biology, is maintained on the Illinois River by the State Laboratory of Natural History. It has its separate staff, but is open to students of the University at

all times, on application, and during the summer months to special students not connected with the University.

A *laboratory for sanitary water analysis* has been equipped with all necessary appliances, and chemical investigation of the water supplies of the state is carried on.

COLLECTIONS

AGRICULTURAL

The various agricultural departments maintain collections illustrative of their work, prominent among which are those showing typical specimens of standard varieties of corn, wax models of fruit and vegetables, an extensive horticultural herbarium, specimens of many breeds of live stock, a large collection of farm machinery, and exhibits of negatives and samples showing progress of certain investigations, as with fruit and with corn.

BOTANICAL

The *herbarium* contains about 50,000 mounted specimens of plants. The flora of North America is fairly well represented, the collection of species of flowering plants indigenous to Illinois is particularly complete, and a considerable collection of foreign species has been made. The collections of fungi amount to 32,000 named specimens, and include a full set of those most injurious to other plants, causing rusts, smuts, moulds, etc. There are specimens of wood from 200 species of native trees and shrubs, which well illustrate the varieties of native wood.

Plaster casts represent fruits of many of the leading varieties, as well as interesting specimens of morphology, showing peculiarities of growth, effects of cross-cultivation, etc.

ENGINEERING

The following departments of the College of Engineer-

ing have made extensive and valuable collections, which are placed in rooms in Engineering Hall.

Architecture

A large number of specimens of stone, bricks, terra cotta, sanitary fixtures, casts of moldings and of ornament have been accumulated, together with some excellent specimens of industrial arts, models of structures, working drawings of important buildings, 4,588 lantern slides, 20,000 plates and photographs, an excellent working library, and a large classified collection of plates from architectural journals.

Civil Engineering

The civil engineering department has a large room containing samples of iron, steel, wood, brick, and stone; materials for roads and pavements; models of arches and trusses, one of the latter being full-sized details of an actual modern railroad bridge. The department also possesses a very large collection of photographs and blue-print working drawings of bridges, metal skeleton buildings, masonry structures, and standard railroad construction.

Electrical Engineering

The department has a collection of samples illustrating standard practice in the industrial applications of electricity. There is also a rapidly growing collection of lantern slides, photographs, blue-prints, drawings, pamphlets, and other engineering data.

Mechanical Engineering

This department has among other things a partial set of Reuleaux models, together with models of valve gears, sections of steam pumps, injectors, valves, skeleton steam and water gauges, standard packings, steam-pipe coverings, and drop forgings. There are also fine examples of castings, perforated metal, defective boiler plates, and

sets of drills, with numerous samples of oil, iron, and steel. A large number of working drawings from leading firms and from the United States Navy Department forms a valuable addition to the above collections.

GEOLOGICAL

Lithology is represented by type collections of rocks (9,000 specimens), arranged to illustrate Rosenbusch; from Voight and Hochgesang, L. Eger, and A. Kranz; a type collection from Ward; 1,000 thin sections of rocks and minerals; a large number of ornamental building stones; a stratigraphic collection to illustrate Illinois geology, and a collection of Illinois soils (104).

The *Mineralogical* collection is especially rich in rock-forming minerals, ores, and materials of economic value. It contains over 12,000 specimens carefully selected to meet the wants of the student, and 575 crystal models.

The *paleontological* collection (49,000 specimens) contains representative fossils from the entire geologic series, but is especially rich in paleozoic forms. It embraces the private collections of A. H. Worthen (including 742 type specimens); Tyler McWhorter; Mr. Hertzer; 200 thin sections of corals; the Ward collection of casts, and a considerable number of special collections representing the fauna and flora of particular groups.

LIBRARY ECONOMY

A collection of books and phamplets on library science, of library reports and catalogs, of mounted samples showing methods of administration in all departments, and of labor-saving devices and fittings has been made, and is arranged by the Dewey Decimal classification in the Library School seminary room.

PEDAGOGICAL

In the rooms of the department of education in University Hall is a considerable collection of illustrative material from the manual training departments of various schools; photographs of school buildings, drawings and construtive work by pupils in the public schools, and the nucleus of a representative collection of apparatus for the school laboratory.

ZOOLOGICAL

The *zoological* collections have been specially selected and prepared to illustrate the courses of study in natural history, and to present a synoptical view of the zoology of the state.

The mounted mammals comprise an unusually large and instructive collection of the ruminants of our country, including male and female moose, elk, bison, deer, antelope, etc., and also several quadrumana, large carnivora and fur-bearing animals, numerous rodents, good representative marsupials, cetaceans, edentates, and monotremes. Fifty-nine species of this class are represented by one hundred and one specimens and all the others, excepting the Sirenia, are represented by mounted skeletons. There is also a series of dissections in alcohol, illustrating the comparative anatomy of the group.

The collection of mounted birds includes representatives of all the orders and families of North America, together with a number of characteristic tropical, Bornean and New Zealand forms. The collection is practically complete for Illinois species. There is also a fine collection of the nests and eggs of Illinois birds. A series of several hundred unmounted skins is available for the practical study of species, and the internal anatomy is shown in alcoholic dissections, and in mounted skeletons of all the orders.

The cold-blooded vertebrates are represented by a series of mounted skins of the larger species, both terrestrial and marine; mounted skeletons of typical representatives of the principal groups; alcoholic specimens; both entire and dissected, and casts. The alcoholics include series of the reptiles, amphibians, and fishes, the latter comprising about 300 species. The dissections illustrate the internal anatomy of the principal groups. The casts represent about seventy-five species, nearly all fishes.

The mollusca are illustrated by alcoholic specimens of all classes and orders, and dissections showing the internal anatomy of typical forms. There are several thousand shells belonging to 1,700 species. The collection of Illinois shells is fair but incomplete.

The collection of insects has been greatly extended and enriched by the Bolter Collection, donated to the University by the executors of the estate of the late Andreas Bolter, of Chicago, which now contains over 16,000 species, represented by about 120,000 specimens, named, labled, and systematically arranged.

The lower invertebrates are represented by several hundred dried specimens and alcoholics, and by a large series of the famous Blaschka glass models.

The embryology of vertebrates and invertebrates is illustrated by several sets of Ziegler wax models, and numerous series of slides, sections, and other preparations.

In addition to the above, the extensive collections of the State Laboratory of Natural History are available for illustrative purposes, as well as for original investigation by advanced students.

ART GALLERY

The University Art Gallery was the gift of citizens

of Champaign and Urbana. It occupies a room in the basement of the Library Building, and furnishes an excellent collection of models for students of art. In sculpture it embraces thirteen full-size casts of celebrated statues, forty statues of reduced size, and a large number of busts and bas-reliefs, making in all over 400 pieces. It includes also hundreds of large autotypes, photographs, and fine engravings, representing many of the great masterpieces of painting of nearly all the modern schools, and a gallery of historical portraits, mostly large French lithographs, copied from the great national portrait galleries of France.

Other collections of special value to art students embrace a large number of casts of ornament from the Alhambra and other Spanish buildings, presented by the Spanish government; a set of casts from Germany, illustrating German renaissance ornament; a series of art works from the Columbian Exposition; large numbers of miscellaneous casts, models, prints, and drawings, such as are usually found in the best art schools, and a model in plaster and a complete set of drawings of a competitive design by Henry Lord Gay for a monument to be erected in Rome, commemorative of Victor Emmanuel, first king of Italy.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, and that of the College of Law are all at the University in Urbana. The libraries of the Colleges of Medicine and Dentistry and of the School of Pharmacy are in Chicago.

The general University library contains 63,724 volumes and 14,512 pamphlets. The reading room contains 755 periodicals. The library of the State Laboratory of Natural History contains 5,350 volumes and 15,850 pamph-

lets. The Library of the College of Law contains the Federal and State Reports, the leading text-books, and a line of leading periodicals. The department of education has made a special collection of about 1,500 books and 5,000 pamphlets, which are kept in the rooms of the department in University Hall. This collection contains a very good assortment of modern text-books, and copies of the courses of study of nearly all the large city school systems.

The Quine Library of the College of Medicine practically contains every book of reference required by medical students and all of the important medical periodicals.

The general library at the University is open daily, except Sunday, from 8 a. m. until 5 p. m. and from 6:30 p. m. until 9 p. m. on Mondays, Tuesdays, Wednesdays, and Thursdays. The reading rooms are open from 8 a. m. until 9 p. m. on Mondays, Tuesdays, Wednesdays, and Thursdays, and until 5 p. m. Fridays and Saturdays.

The Public Library of the City of Champaign contains the valuable library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical Society. The collection is accessible to University students.

THE GRADUATE SCHOOL

Thomas J. Burrill, Ph.D., LL.D., Dean.

HISTORY

The Graduate School was established in 1892, for the purpose of offering facilities for advanced study and research to graduates in a more systematic way than had hitherto been done in the University. In 1894 the School was placed in the general charge of the newly organized Council of Administration and the office of Dean was established. To the Dean was assigned the executive or administrative duties required. Graduate instruction had been given in certain departments of the University, and second, or master's degrees had been annually conferred during several years before the establishment of the Graduate School, but no conditions had been previously formulated upon which the doctor's degree (Doctor of Philosophy) would be given. The first publication of the requirements for this degree appeared in the Catalog for the year 1893-4 and the conditions then announced have since remained in force. The degree however, was not conferred until 1903, when two candidates successfully passed the prescribed requirements.

In order further to promote graduate study the provision was made when the School was established that its members should pay no fees of any kind and four fellowships were created each with a stipend of $400. Later, two more fellowships of the same value were added in the same way by the trustees. In 1896 these were changed to eight fellowships of $300 each. In 1904 the payment by graduates of the same fees required of undergraduates was ordered, except that fellows continue excused from such payments.

ADMISSION AND REGISTRATION

Graduates of the University of Illinois, and of other colleges and universities of approved standing, may be admitted to membership in the Graduate School upon presentation of their credentials. Other persons suitably qualified may gain admission by special vote of the Council of Administration upon such conditions as may be imposed in each case. To gain admission to particular graduate courses or departments the special preparation for this must be found sufficient, and an advanced degree for which candidacy is sought must be in line with the bachelor degree received. Candidates for admission may secure application blanks from the Dean or from the Registrar of the University, and these, properly filled out, should be filed, together with such documentary matter as may be presented, showing qualifications for membership in the School, with the former officer. This should be done not later than the time set for registration in September. Admission may be granted at other times, but the time limit required for degrees counts from the date of the certificate of membership.

With the exceptions named below, all members of the Graduate School are required to be in regular attendance at the University, and to do all the work for which they are registered in the departments to which such work belongs. In case of absence on leave, or when absence is necessary to carry on investigations included in approved courses of study, the requirement of continuous residence may be modified by the Council of Administration.

Graduates of this University may be admitted to nonresident membership in the Graduate School, as candidates for second or masters' degrees. In this case correspondence should first be addressed to the head of the department in charge of the major subject desired. All

members of the School who have completed the residence required for advance degrees may register as non-residents while completing the work required for such degrees.

Members of the Graduate School register with the Dean during the registration days, at the beginning of the collegiate year.

Those only are enrolled as members of the Graduate School who enter upon or pursue approved graduate work as explained under "Studies and Examinations" below. Resident graduates who are candidates for bachelor degrees are not included, neither are those who, not working for any degree, have registered without a major subject approved as graduate work.

STUDIES AND EXAMINATIONS

As far as can be indicated by a statement of time, full work for a graduate student consists in the use of forty-five hours a week in the lecture rooms, laboratories, etc., and in private study, equal to 30 *semester hours*' credit, exclusive of the preparation of a thesis. A semester hour is the credit given for one study on which the student is supposed to spend 3 hours of time each day 5 days a week for 18 weeks. Assignments of work are made upon this basis; but great variations naturally result from the subject-matter in hand, and from the abilities of individuals.

Each student must select one principal line of study, and upon this major subject at least one-half, 15 "hours," and in the subjects of the College of Engineering at least two-thirds, 20 "hours", of his work must be done; and any greater proportion of his time, up to the whole of it, may thus be devoted if proper approval is had. When work upon the selected major subject is not arranged to require all of the student's attention, he must choose one or two minor subjects, as may be necessary to complete a full course of study, 30 "hours". Usually, at least one

minor subject should be taken. Not more than two may be taken at the same time.

The major study must be approved as graduate work for this University, preceded by an amount of undergraduate preparation specified in connection with the courses of study or determined by the officers in charge. The minor subjects may, under approval, be chosen from the offerings to graduates, or from undergraduate courses of advanced grade, except that all work must be selected from graduate offerings in the subjects of the College of Engineering. In these the major line of study must be either a single subject or a combination of related subjects. But all candidates for advanced degrees must direct their selections toward some well-defined end, determined for the most part by the character and purpose of the major study.

All courses of study leading to degrees in the Graduate School are subject to approval, first, by the head of the department of the University in which the major subject for each student belongs; second, by the Dean of the College including such department; and, third, by the Dean of the Graduate School. The signatures of the heads of departments in which chosen minor subjects belong must also be obtained before the list reaches the Dean of the Graduate School. The lists of studies, as finally approved, are deposited with the Registrar of the University. No changes may subsequently be made except under the same line of approvals, but extension of time may be arranged with the professors concerned and with the Dean of the Graduate School.

Examinations are required in all subjects, and reports upon these are made to the Registrar of the University. Graduate students in undergraduate classes are examined with these classes.

The head of the department in which the student does his major work is charged with the direction and supervis-

ion of such major work, and, in a general way, with the supervision of the student's entire course of study. He fixes the time and method of all examinations not otherwise provided for, sees that they are properly conducted, and reports results to the Registrar. It is his duty also to keep the Dean of the Graduate School informed concerning all matters affecting the interests of the student, and of the School in connection therewith.

DEGREES

No degrees are given for study *in absentia*, except that graduates of this University, who become members of the Graduate School and reside elsewhere, may receive a master's degree upon the completion of their courses of study within not less than three years of the date of registration. Advanced degrees are conferred by the Trustees of the University only upon recommendation of the Senate, based upon information furnished by the Council of Administration.

Second Degrees

The second degrees conferred by this University are as follows:

Master of Arts, after Bachelor of Arts.

Master of Science, after Bachelor of Science, in courses in the College of Agriculture.

Master of Architecture, after Bachelor of Science, in courses of Architecture and Architectural Engineering.

Civil Engineer, after Bachelor of Science, in the course in Civil Engineering.

Electrical Engineer, after Bachelor of Science, in the course in Electrical Engineering.

Mechanical Engineer, after Bachelor of Science, in the course in Mechanical Engineering.

Pharmaceutical Chemist, after Graduate in Pharmacy.

All candidates for second degrees are required to regis-

ter in the Graduate School, to conform to the conditions outlined under "Admission and Registration," and "Studies and Examinations" (pp. 26 and 27); to pursue an approved course of study for one academic year in residence, or, in the case of graduates of this University, for three years *in absentia*; and to pass satisfactory examinations upon all the studies of the approved course.

Each candidate for a second degree must present an acceptable thesis in the line of his major subject of study. The subject of this thesis must be announced to the Dean of the Graduate School not later than the first Monday in November of the academic year in which the course is to be completed. The completed thesis, upon regulation paper, must be presented, with the certified approval of the professor in charge, to the Council of Administration not later than June 1st.

The period of required study begins from the date of registration in the Graduate School.

Doctor's Degree

The Degree of Doctor of Philosophy may be conferred upon any member of the Graduate School of not less than three years' standing who shall have reached high attainments in scholarship, including a sufficient knowledge of the French and German languages to serve the purposes of research in his principal specialty, who shall have shown marked ability in some line of literary or scientific investigation, and shall have presented a thesis giving clear indications of such scholarship and of such power of research. At least the first two, or the last one, of the three years of study must be in residence at the University, and the entire course of study must be in accordance with the regulations of the Graduate School.

The time and study required for a master's degree may be included in the three years required, but approval of a

course of study for a doctor's degree must be upon the condition that the candidate is prepared through his baccalaureate work, or otherwise, to enter at once upon advanced studies in the line of his major subject, and that work on his major subject be continued through the three years.

The final examination of a candidate for the doctor's degree is conducted by a committee consisting of the head of the department under which the major subject has been pursued, as chairman, and of not less than two additional members of the Senate of the University, appointed for the purpose by the Council of Administration. This examination covers the subjects of the course approved for the degree, but is especially searching upon that on which the major work has been done.

Each candidate for a doctor's degree must announce to the Dean of the Graduate School a thesis subject not later than the first Monday in November of the academic year at the close of which the award of the degree is expected. A fair copy of the thesis must be submitted, with a certified approval of the committee on examinations, to the Council of Administration not later than the first day of June. If the thesis is approved by the Council the candidate must have it printed and must deposit not less than one hundred copies with the librarian of the University.

FELLOWSHIPS

The Trustees of the University have established a number of fellowships, each with a stipend of three hundred dollars, payable in ten monthly installments.

The rules governing appointments to these fellowships are as follows:

1. The purpose of these fellowships shall be to promote advanced scholarship and original research in the University.

2. The fellowships shall be open to graduates of this and similar institutions. Those who are to complete an under

gradute course previous to the academic year for which appointments are made shall be eligible, with others, as candidates.

3. Nominations to fellowships, accompanied by assignments to special departments of the University, shall be made by the Council of Administration to the Trustees of the University, upon applications received by the President of the University each year not later than the first day of February. These nominations shall be made at a meeting of the Council called for that purpose within the month of February. The appointments by the Trustees are made at their regular meeting in March, and shall take effect the first day of the following September. Vacancies may be filled by similar nominations and appointments at other times.

4. Nominations to fellowships shall be made upon the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Consideration shall also be given to the probable value or usefulness of the services of the candidate as an assistant in instruction, but this shall not be deemed the primary object of the appointment. Other things being equal, preference is given to those graduates of this University who have pursued a specialized or group course.*

5. Candidates must present, with their applications, full information concerning themselves and their qualifications for advanced study and research work, including any written or printed essays or results of investigation, and must name the subject in which they wish to do their major work.

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*All members of the Colleges of Engineering and Agriculture, of the chemical and mathematical groups in the College of Science, of the College of Law, and of the Schools of Library Science and Music, are considered as pursuing specialized courses.

6. Fellowships are good for one year, but appointments may be renewed to the same person. An appointment as *honorary fellow*, without stipend, may be made as specified for paid fellowships in the case of anyone who has held a regular fellowship and has shown distinguished merit in his work.

7. Fellows shall be constituted members of the Graduate School, shall have all of the privileges and bear all of the responsibilities of such membership. Each regular fellow may be called upon to render service in instruction throughout the year in the department in which his major subject lies, equal to one hour daily of class instruction or to two hours daily of laboratory supervision. This service will receive such credit as the Council of Administration may determine in each case. Blank forms for application may be obtained by addressing the Registrar, or the Dean of the Graduate School.

GENERAL DESCRIPTION OF COURSES

Following the description of each course of instruction will be found the necessary requirements, if any, for admission to that particular course.

Credit is reckoned in semester "hours," or simply "hours." An "hour" is one class period a week for one semester, each class period pre-supposing two hours' preparation by the student, or it is the equivalent in laboratory, shop or drawing room.

The semester, the days, and the class period or periods during which each course is given, and the number of "hours" per semester for which the course counts, are shown after each course, as follows: The semester is indicated by the Roman numerals I., II.; the days by the initial letters of the days of the week; the class period or periods (of which there are nine each day, numbered consecutively from one to nine), by Arabic figures; and the "hours" or amount of credit, by Arabic figures in parenthesis.

SUBJECTS OF THE COLLEGE OF LITERATURE AND ARTS

ECONOMICS

(Including Commerce and Industry).

The work of the department of economics is expanded in the direction both of societal economics and industrial economics. A graduate student may pursue work in either line. No student will be permitted to elect economics as a major unless he has had a thorough course in the principles. Students who are not considered sufficiently well grounded will be required to take an elementary course in conjunction with, or preparatory to, their other work, but it cannot be counted towards an advance degree.

The department is thoroughly equipped both in library and in staff for the training of students in economic research in social and industrial lines. The Library contains complete sets of all important economic serials, in English, French, and German, is well equipped in practically all important lines of economic research, and has abundant material in several.

The opportunities for work in statistics, theoretical and practical, are unusually good. The University possesses a number of calculating machines of various kinds which are accessible to advanced students in their research work.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

3. Money and Banking.—The history and theory of money and banking, and the monetary history of the United States. II.; M., W., F.; 4; (3). Assistant Professor Weston.

Required: Economics 1, or 2 and 7.

4. Financial History of the United States. — A brief survey of the fiscal systems of the American colonies followed by a study of national finances from the beginning of the American

Revolution down to the present time. I.; M., W., F.; 2; (3). Assistant Professor HAMMOND.

Required: Economics 1.

5. PUBLIC FINANCE.—A study of the principles which should be followed in making public expenditures and in securing public revenues. II.; Tu., Th.; 4; (2). Assistant Professor HAMMOND.

Required: Economics 1.

6. TAXATION.—An investigation into the methods of taxation in the various American Commonwealths. II.; M., W., F.; 2; (3). Assistant Professor HAMMOND.

Required: Economics 5.

8. THE MONEY MARKET.— An advanced course dealing with rates of exchange, functions of bill broker and banker, causes of fluctuations in rates of discount, the concentration of financial dealings at such centers as New York and London, international payments and the determination of rates of foreign exchange. II.; Tu., Th.; 3; (2). Professor KINLEY.

Required: Economics 3 and 9.

9. BANKING.—A course in the study of practical banking, with special reference to the United States, England, Germany, France and the Orient. I.; Tu., Th.; 7; (2). Assistant Professor WESTON.

Required: Economics 3.

10. CORPORATION MANAGEMENT AND FINANCE.—The growth of corporations; their organization and securities, position and relations of stockholders and directors, analysis of reports, stock speculation, relation of industrial corporations to international competition, receiverships and reorganizations, social and political effects. I.; M., W., F.; 2; (3). Professor ROBINSON.

Required: Economics 1, or 2 and 7 or 22.

11. INDUSTRIAL CONSOLIDATIONS. — The development of industrial consolidations, their causes and forms; the promotion, financiering, incorporation and capitalization of corporate consolidations; monopoly prices and monopoly methods; the ability of trusts to affect prices, wages, interest and profits; and the proposed plans for controlling trusts, such as publicity, taxation of profits, and public ownership. II.; M., W., F.; 2; (3). Professor ROBINSON.

Required: Economics 10.

12. THE LABOR PROBLEM. — The labor movement and its

social significance. The progress of the laboring classes, strikes, arbitration, labor organizations, and similar topics, which are studied, show the general character of the course. I.; W., F.; 4; (3). Professor KINLEY.

Required: Economics 1. [Not given in 1904–05.]

13. RAILWAY MANAGEMENT. — This course considers from the administrative standpoint railways as factors in the social and industrial development of the United States and treats of the following topics:—(1) Historical: conditions of commerce and industry previous to the advent of the railways; primitive methods of transportation, etc. (2) Geographical: the economic location of railways, etc. (3) Organization; charter and franchises; capital stock; directors and stockholders; departments; the distribution of authority and responsibility; (4) Traffic management; (5) Financial: basis of capitalization; use of stocks and bonds; stock watering; distribution of earnings; reports and their interpretation, etc.; (6) Legal: rights and duties of railways; their status under the common and statute law; relation to leased lines; to employes; to patrons; taxation; public control through commissions. I.; M., W., F.; 4; (3). Professor ROBINSON.

Required: Economics 1, or 2 and either 7, 16 or 22. From junior and senior engineers economics 2, only, will be required.

14. RAILWAY SYSTEMS. — This course is a continuation of course 13. II.; M., W., F.; 4; (3). Professor ROBINSON.

Required: Economics 13.

17. SOCIOLOGY. — This course deals with the principles underlying social organization, and with the nature and development of social institutions. Special attention is given to the study of the family, the state and to race assimilation in the United States. The latter part of the course treats practical problems of charity and crime. II., M., W., F.; 1; (3). Assistant Professor HAMMOND.

Required: At least 28 hours of University credit.

18. ECONOMIC SEMINARY. — For investigation and for the study of current economic literature. I., II.; *arrange time.* Professors KINLEY, FISK, ROBINSON, HAMMOND, WESTON.

20. HISTORY OF ECONOMIC THOUGHT. — The history of the development of economic theory since the sixteenth century. I., II.; 7; (2). Professor KINLEY.

Required: 10 hours in economics.

21. Socialism and Social Reform.—II.; M., W., F.; 7; (3). Assistant Professor Weston.

Required: Economics 1, or 2 and 7.

23. Statistics. — A course in descriptive statistics. The course may be taken by itself, but is better taken with the first half of course 24. II.; F.; 7; (1). Assistant Professor Hammond.

Required: Economics 1 or 2.

24. Statistics. — Students of economics should take this course and 23 together. Those who do not wish the mathematical theory of probability may drop out of the class when that part of the subject is reached. For them the mathematical requirement for entrance is not enforced, and courses 23 and 24 count for four hours' credit. All who take the course must take both parts of it, as described under mathematics 26, which see.

Required: Economics I, or 2 and 7.

27. History of Commerce.—A general survey of commerce from ancient times, with special stress on the growth of commerce since the discovery of America. I.; M., W., F.; 3; (3). Professor Fisk.

Required: Economics 1, 7 and 26.

28. Domestic Commerce and Commercial Politics. — A comparative study of the various forms of commercial organization, such as general wholesale and retail trade, department, co-operative, and company stores, peddling, huckstering, and hawking,booths, auctions, commercial agents, including commercial travelers, and the coupon system. I.; M., W., F.; 3; (3). Professor Fisk.

Required: Economics 1, 7 and 26. [Not given in 1904–05.]

29. Foreign Commerce and Commercial Politics. — Continuation of course 28. A study of the various commercial systems (mercantile, free trade, and protective); kinds of tariffs; commercial treaties, reciprocity; commercial statistics and balances; institutions for furthering export trade (commercial museums and bureaus of information,'sample houses, consular reports, etc.) II.; M., W., F.; 3; (3). Professor Fisk.

Required: Economics 1, 7 and 26. [Not given in 1904–5.]

30. History of the Commercial Policy of the United States.—An historical study of all those measures, such as tariff legislation, commercial treaties, navigation laws, bounties, sub-

sidies, consular matters, etc., which have an important bearing on the commercial side of the foreign relations of the United States. I., II.; M., W., 3; (2). Professor Fisk.

Required; Economics 1, 7, or 22 and 26.

31. History of the Commercial Relations of the United States. I., II.; M., W.; 4; (2). Professor Fisk.

Required: Economics 30.

32. Domestic and Foreign Markets of the United States.—One hour a week is devoted to a study of the distribution and domestic marketing of American products, especially farm products, while the second hour is given to a study of foreign markets for American exports. I., II.; W., F.; 4; (2). Professor Fisk.

Required: Economics 28, 29; or 27, 30.

33. Economics of Insurance. — The historical development of insurance, and an extended discussion of its economic aspects. The various forms of insurance—fire, accident, employment and life,—from the standpoint of internal organization and from that of social service. Rates, policies, investments, corporate management, accounting, public supervision, and insurance law. I.; *arrange time*; (2). Professor Robinson.

Required: Economics 10, 24.

34. Corporation Accounting.—The general principles of accounting and auditing in modern business. The report of railway, banking and industrial corporations are analyzed. The work is supplemented with a series of lectures by practical accountants. II.; Tu., Th.; 3; (2). Professor Robinson.

Required: Economics 10.

35. Consular and Diplomatic Service.—A comparative study of the consular service of the important countries, and of the diplomatic service so far as it affects foreign commerce. Special attention is given to the foreign service of the United States. I., II.; F.; 4; (1). Professor Fisk.

Required: Economics 30 and 31.

COURSES FOR GRADUATES

101. Recent Economic Theory.—For the year 1904–05. Theories of Wages and Profits is the subject of study. I., II.; *arrange time.* Professor Kinley.

102. Historical and Comparative Finance.—This course

is devoted to original investigation by the student and to reports and discussion in class, supplemented with lectures by the instructor. The work is conducted each year along the following lines. (1) A comparison of financial theories concerning public expenditures, the principles of justice in taxation, the incidence of taxes and the relation of taxation to social reform; (2) a comparison to the financial system of the United States with those of foreign countries; (3) a comparison of the taxing systems of the American commonwealths. For 1904–05 the last named subject has been selected. I., II.; *arrange time*; (2). Assistant Professor HAMMOND.

103. SEMINARY IN RAILWAY ADMINISTRATION.—Advanced students in this subject make a detailed study of one of the branches of railway administration. I., II.; *arrange time*; (2) Professor ROBINSON.

104. SEMINARY IN COMMERCE.—A study of present international commercial relations, with special reference to the trade conditions of the United States and the extension of her trade to foreign markets. I., II.; *arrange time*; (2). Professor FISK.

EDUCATION

Under the direction of this department are offered the pedagogical and the psychological courses included within the University curriculum. In both of these fields of study the department is well equipped for graduate instruction. The University Library, besides containing the files of nearly all the important serial publications in each, is well provided with the general and technical works which are essential to advanced study. Besides this, the department possesses a pedagogical library of upwards of 1,000 volumes and 5,000 reports, courses of study, etc., covering the general field of education which provides an invaluable field for the investigation of problems of school organization and administration. For work in psychology there is a laboratory, adequate for present needs, consisting of three rooms (beside a dark room) fully equipped with apparatus both for elementary instruction and for

the prosecution of research within the field of psychology. Although the department has no mechanician of its own, it has a well furnished work-shop in which the more simple pieces of apparatus for special investigation may be constructed and through arrangements with the shops of the College of Engineering the more elaborate ones are built.

Matriculants for major work either in pedagogical or psychological courses are supposed to have had at least one year's previous study in them.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

A. Pedagogical.

4. CONTEMPORARY EDUCATIONAL CONDITIONS AND MOVEMENTS IN THE UNITED STATES. I ; (2). Professor DEXTER.

5. A COMPARATIVE STUDY OF THE SECONDARY SCHOOL SYSTEMS OF FRANCE, GERMANY, ENGLAND, AND AMERICA. II; (2) Professor DEXTER.

6. HIGH SCHOOL ORGANIZATION AND MANAGEMENT. II.; (3)

7. SPECIAL METHODS IN SCIENCE AND MATHEMATICS. I., (2)

8. SPECIAL METHODS IN LANGUAGE AND HISTORY. I.; (2) Assistant Professor COLVIN.

9. EDUCATIONAL PSYCHOLOGY. II.; (2). Professor DEXTER.

10. SEMINAR, COVERING GENERAL PROBLEMS IN SCHOOL MANAGEMENT AND SUPERVISION. I., II.; (1). Professor DEXTER.

B. Psychological.

3 AND 4. EXPERIMENTAL PSYCHOLOGY.—A full laboratory course for the year. I., II.; (5). Professor DEXTER and Assistant Professor COLVIN.

5. GENETIC PSYCHOLOGY. II.; (2). Assistant Professor COLVIN.

6. COMPARATIVE PSYCHOLOGY. I.; (2). Assistant Professor COLVIN.

7. SEMINAR. I., II.; (1); Assistant Professor COLVIN.

8. THE PSYCHOLOGY OF THE EMOTIONS AND THE WILL. II,; (2). Assistant Professor COLVIN.

No courses strictly for graduate students are announced by the department, but arrangements are made with such students individually and such courses arranged as meet the particular needs. University credit varying in amount from one to five semester hours is given for this work.

ENGLISH LANGUAGE AND LITERATURE

The library contains all the principal journals devoted to English philology and many society transactions and other special publications together with complete sets of most of the standard English periodicals of the nineteenth century. A portion of the department library fund is reserved for buying special material for advanced students.

At least three years of college work in English is required for major work in this subject. Students who have not had one year of Old English (Anglo Saxon) must elect ENGLISH 8.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

5. SHAKESPEARE AND THE HISTORY OF THE DRAMA. I., II.; (3). Professor DODGE.

6. ENGLISH CRITICISM IN THE NINETEENTH CENTURY. I., II.; (2). Mr. PAUL.

7. ENGLISH FICTION IN THE EIGHTEENTH AND NINETEENTH CENTURIES. I., II.; (2). Associate Professor JAYNE.

8. OLD ENGLISH (ANGLO SAXON) PROSE. I., II.; (3). Professor DODGE.

15. METHODS OF TEACHING ENGLISH LITERATURE. I., II.; (1). Professor DODGE, Associate Professor JAYNE, Assistant Professor BALDWIN, Mr. PAUL.

19. THE LITERARY STUDY OF THE BIBLE. 1., II.; (3). Assistant Professor BALDWIN.

24. BROWNING.—Rapid critical reading of the poems. 1.; (3). Miss KYLE.

25. CHAUCER.—Critical reading of the principal poems. I.; (2). Professor DODGE.

26. ENGLISH BALLADS. II.; (2). Professor DODGE.

COURSES FOR GRADUATES

101. Research Course in Sixteenth Century Literature.—Professor Dodge and Assistant Professor Baldwin.

102. Research Course in Eighteenth Century Writers.—Professor Dodge and Associate Professor Jayne.

103. Research Course in Nineteenth Century Writers.—Associate Professor Jayne and Mr. Paul.

GERMAN

Courses in German primarily for graduates include courses in Old and Middle High German and a seminary for training independent literary investigation. These are supplemented by the more advanced of those courses which are primarily for undergraduates.

The Library is well equipped with works in German literature, especially of the classical and modern periods. It contains also complete files of the most important periodicals.

Graduate students whose major is German must have had at least three years of University German or its equivalent. They must take courses 101, 102, 103, and in addition six semester hours from among courses 8, 9, 25, and 27. For further work, any of the other courses described below, are open to graduate students.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

7. Heine's Prose; German Lyrics.—Rapid translation and sight reading of selections from Heine's Prose; study of lyric verse using as a guide Hatfields's German Lyrics and Ballads. I.; M., W., F.; (3). Assistant Professor Meyer.

8. Schiller.—The life of Schiller, and study of Wallenstein and other selections. I.; Tu., Th.; 3; (2). Assistant Professor Brooks.

9. Goethe's Faust.—Part I, and portions of part II. I.; M., W., F., 3; (3). Assistant Professor Meyer.

10. Goethe.—The life of Goethe, and study of selections

from his lyrics, classical dramas, and prose works, II.; M., W., F.; 7; (3). Assistant Professor MEYER.

11. HISTORY OF MODERN GERMAN LITERATURE.—Lectures, recitations, and reports on assigned collateral reading. II.; Tu., Th.; 7; (22). Assistant Professor BROOKS.

12. RECENT AND CONTEMPORARY PROSE FICTION.—Rapid reading of works by Freytag, Dahn, Keller, Heyse, Sudermann, and others. I.; Tu., Th.; 7; (2). Assistant Professor BROOKS.

23. THE ROMANTIC SCHOOL.—Rapid translation and sight reading; reports on assigned reading. I.; M., W., F.; 4; (3). Miss BLAISDELL.

24. RECENT AND CONTEMPORARY DRAMA.—Study of Dramas by Heyse, Hauptmann, Wilbrandt, Fulda, Sudermann, and others. II.; M., W., F.; 4; (3). Assistant Professor BROOKS.

25. TEACHERS' COURSE.—Lectures, discussion of methods, examination of text-books. II.; Tu.; 7; (1). Assistant Professor MEYER.

26. GERMAN LITERATURE BEFORE THE REFORMATION.—Lectures, recitations and reports on assigned reading; the course is intended to cover the period not included in course 11, and students who intend to take course 11, are advised to elect course 26. I.: Tu.; 8; (1). Assistant Professor BROOKS.

27. LESSING.—The life of Lessing, and study of Nathan der Weise and other selections. II.; M., W., F.; 3; (3). Assistant Professor MEYER.

COURSES FOR GRADUATES

101. INTRODUCTION TO MIDDLE HIGH GERMAN.—I.; M., W., F.; 8; 3. Assistant Professor BROOKS.

102. OLD HIGH GERMAN AND ELEMENTS OF HISTORICAL GRAMMAR.—II.; Tu.; Th.; 8; (2). Assistant Professor BROOKS.

103. SEMINARY IN MODERN GERMAN LITERATURE.—I. or II.; (2). Assistant Professor MEYER.

GREEK

The undergraduate courses offered in the Catalog constitute about six years' work. For registration with Greek as a graduate major, at least the first four years, or their equivalent, and an approved bachelor's degree are required.

Graduate minor courses are offered upon arrangement as follows: (a) the History of Classical Philology; (b) General Introduction to the Science of Language; (c) the Private and Public Life of the Greek People.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

9. GREEK ORATORY.—I.; M., W., F.; 4; (3). Professor Moss. *Required:* Greek 8.

10. GREEK TRAGEDY.—I.; Tu., Th.; 2; (2). Professor Moss. *Required:* Greek 8.

11. HOMER.—The ILIAD.—II.; M., W., F.; 4; (3). Professor Moss.

Required: Greek 8.

12. THUCYDIDES.—II.; Tu., Th.; 4; (2). Professor Moss. *Required:* Greek 8.

HISTORY

With a view to offering opportunities for advanced work with the sources, the documentary collections of the University Library have been greatly strengthened. The following complete, or nearly complete, collection of source-material may be specially noted:

AMERICAN HISTORY.—The records of debates in Congress in their various forms from 1789 to the present time; the *Journals* and *Secret Journals* of the Continental Congress before 1789; the *American State Papers*, and the congressional documents or reports; the *U. S. Statutes at Large*; The U. S. Supreme Court reports; the colonial statutes of Massachusetts, New York, Pennsylvania, and Virginia; the legislative and judicial documents of Illinois; the collected writings, usually in the latest editions, of most of the "Fathers of the Republic" and of many of the late statesmen.

ENGLISH HISTORY.—*The Statutes of the Realm*; House of Commons, *Journals*; Cabbeth, *Parliamentary History* and Hanson, *Parliamentary Debates*; the *Annual Register*; Pickering, *Statutes at Large.* The resources of the University Library are supplemented by those of the Champaign City Library which contains the books on western history, collected by the late Edward G. Mason, President of the Chicago Historical Society.

Though it is impossible to draw a hard and fast line between advanced undergraduate and graduate work, candidates for advanced degrees, with history as a major, must have had at least two years of undergraduate work in this subject. Work in the related social science will be accepted in partial substitution for that required in history.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

4. English Constitutional History.—I., II.; M., W., F.; 2; (3). Assistant Professor Schoolcraft.

8. The Empire and the Papacy in the Middle Ages.—The conflict of church and state. I., II.; M., W., F. Mr. Alvord.

9. The Period of the Italian Renaissance.—I.; Tu., Th.; 7; (3). Mr. Alvord.

10. The Development of the British Colonial Empire.—I.; M., W., F., 2; (3). Assistant Professor Schoolcraft. [Not given in 1904–05].

11. The Political History of Europe in the Nineteenth Century.—Professor Greene.

13. The Political and Constitutional History of the English Colonies in America.—Professor Greene.

14. The Constitutional History of the United States, 1775–1860.—Professor Greene.

15. The Political and Constitutional History of the United States since 1860.—Professor Greene.

101. The Seminary in American History.— Professor Greene.

102. The Seminary in English History.—Assistant Professor Schoolcraft.

Attention is also called to the courses in economic and financial history offered by the Department of Economics.

LATIN

Professor Barton

The work offered pre-supposes the usual four years' preparatory course and three years of regular college

work. The intensive study of one of the masterpieces of golden or silver Latin will be the basis of the work, supplemented by the study of the Roman novel as found in Petronius and Apuleius. Ansonius and Claudianus will also be considered. Historical Latin Grammar and the private life of the Romans are included in these requirements for the degree of Master of Arts.

PHILOSOPHY

One year's graduate work may, at present, be done in this department. In addition to the courses in philosophy, the student must select, under the guidance of the head of the department of philosophy, advanced courses in psychology, sufficient to complete a full course of study for the year.

The minimum preparation required for admission is a year's work in both psychology and philosophy.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

5. ADVANCED PHILOSOPHY.—The seventeenth century philosophy. A critical study of Descartes, Spinoza, and Leibnitz. I.; Tu., Th.; 7; (2). Professor DANIELS. [Not given in 1904-5].

Required: Two semesters in Philosophy of Psychology.

10. PHILOSOPHIC THOUGHT IN ENGLISH LITERATURE OF THE EIGHTEENTH AND NINETEENTH CENTURIES.—I.; Tu., Th.; 8; (1). Professor DANIELS.

11. PHILOSOPHY OF RELIGION.—The philosophical interpretation of religious consciousness, with reference to the value of a rational view of religious ideas. Open to seniors and graduate students only. I., II.; Tu., 7; (1). Professor DANIELS.

12. THE PHILOSOPHY OF HERBERT SPENCER.—A critical study of his First Principles and Data of Ethics. The influence of the theory of evolution upon modern philosophy. Open to seniors and graduate students only. I.; W., F.; 8; (2). Professor DANIELS.

13. PHILOSOPHY OF NATURE.—The study of scientific conceptions from the philosophic point of view. Man's place in

nature. The relation of mind and body. A critical study of selections from the writings of Clifford, Pearson, Ostwald, and other writers. Open to senior and graduate students only. II.; Tu., Th.; 8; (2). Professor DANIELS.

COURSES FOR GRADUATES

101. THE PHILOSOPHY OF KANT.

ROMANIC LANGUAGES

Graduate students are given ample opportunities to pursue advanced work in the Romanic Languages. The University Library contains a valuable collection of books in these subjects, including back files of the leading periodicals treating of French Literature and Romanic Philology. Additions are constantly being made, and special needs of graduate students will be met so far as possible. The minimum requirement of work previously done is three years of French. To this it is desirable to add courses in Spanish and Italian. In the higher courses intended primarily for undergraduates, additional requirements are made for graduates. The undergraduate courses in Italian and Spanish may be taken as graduate minors.

Prospective teachers of the Romanic Languages should take up the study of the history and development of these tongues. Such study is required of all candidates for the degree of Doctor of Philosophy in Romanic Languages. It is strongly recommended to all candidates for the degree of Master of Arts in this subject.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

3. ADVANCED FRENCH PROSE COMPOSITION AND CONVERSATION.—This course may be taken alone, or, more profitably, with any other course. It is especially designed for students in the courses in business training, and for those intending to teach French. I. II.; Tu., Th.; 2; (2). Professor OLIVER.

4. Nineteenth Century.—A general course on the romantic and realistic novel and drama. Lyric poetry forms also an important share of the work. Modern tendencies are discussed. Lectures, themes, and collateral reading. I., II.; M., W., F.; 2; (3). Mr. Hamilton. [Not given in 1904-5].

5. The Romantic School.—Rise, development and decline of Romanticism in French literature with readings from all representative authors. During the latter part of the year, the characteristics of realism are discussed, and a few productions of the realistic school are read. I., II.; M., W., F.; 2: (3). Mr. Hamilton.

7. Moliere.—Study of the life and times of Molière with reading of the greatest comedies. I.; Tu., Th.; 2; (2). Mr. Hamilton. [Not open to students who have taken French 10].

8. Tragedy of the Classic School.—Rise, development and decline of Classic Tragedy as seen in the works of Corneille, Racine, and Voltaire. II.; Tu., Th.; 2; (2). Mr. Hamilton. [Not open to students who have taken French 10].

9. Non-dramatic Literature of the Seventeenth Century.—Lectures on the culture and society of France in the seventeenth century as expressed in literature not dramatic. The great moralists and philosophers. Memoirs and letters. The Art Poétique and the Satires of Boileau. The fables of La Fontaine. I., II.; M., W., F.; 4: (3). Professor Oliver.

10. Seventeenth Century Drama.—Lectures on the rise and development of French Classic Drama with especial reference to the society of France during this period. Interpretation of the greater masterpieces of Corneille, Racine, Molière and the secondary dramatists. Collateral reading and themes. I., II.; M., W., F.; 4; (3). Professor Oliver. [Not given in 1904-5].

Required: "Twenty hours" credit exclusive of French 7 and 8.

11. Lyric Poetry of France.—The chief emphasis is laid upon Victor Hugo, but poets previous to him are also studied as well as his chief contemporaries and successors. The principles of French versification particularly as exemplified in Hugo and other Romantic writers are studied. I., II.; Tu., Th.; 3; (2). Dr. Jones.

12. Realistic Fiction.—Taking Balzac as its center this course treats in detail the development of French realistic fiction. I., II.; Tu., Th.; 3; (2). Dr. Jones. [Not given in 1904-5].

13. Non-Dramatic Literature of the Eighteenth Century.—Lectures on the society and culture of the eighteenth century. Break-up of the ideals of Classicism. Growth of the Revolutionary spirit. First movements toward Romanticism. Montesquieu, Voltaire and the Encyclopedists, Rousseau, Diderot, Le Sage, and the writers of the Revolution. I., II., M., W., F.; 4; (3). Professor Oliver. [Not given in 1904-5].

14. The Drama of the Eighteenth and Nineteenth Centuries.—The decadence of Classic Drama:—Voltaire—Crébillon. Rise and growth of the *drame bourgeois*, the Romantic drama and the realistic drama. Modern tendencies. The chief works of Beaumarchais, Marivaux, Hugo, Musset, Scribe, Dumas *père*, Augier, Dumas *fils*, Sardou, Coppée, Becque, Hervieu, Rostand, Brieux. Collateral reading with essays. I., II.; M., W., F.; 4; (3). Professor Oliver. [Not given in 1904-5].

COURSES FOR GRADUATES

101. The Sixteenth Century.—The Reformation and the Renaissance. Rabelais, Calvin, Marot, Ronsard, and the Pleiade, Montaigne. Readings from Darmsteter and Hatzfeld's "Le Seizième Siècle en France". Study of the language and syntax of the period. I.; (3). *Arrange time.* Professor Oliver.

102. French Historical Grammar.—Phonetics morphology, syntax. Illustrative readings from Old French texts. I., II.; (3). *Arrange time.* Professor Oliver.

103. History of Old French Literature.—With representative readings from Bartsch's Chrestomathie, La Chanson de Roland, Chrestien de Troyes and other works. The Mediæval drama. I., II.; (3). *Arrange time.* Professor Oliver.

104. Comparative Historical Grammar of the Romanic languages with especial reference to Old French and Provençal. —Illustrative readings. I., II.; (3). *Arrange time.* Professor Oliver.

SUBJECTS OF THE COLLEGE OF SCIENCE

BOTANY

Professor BURRILL and Assistant Professor HOTTES

Graduate botanical studies may be pursued in several lines for which the facilities of the laboratories are ample and the opportunities are in every way sufficient to meet the needs of advanced workers in plant histology, physiology, physiological cytology, pathology, morphology, ecology, and bacteriology.

The undergraduate courses are numbered from 1 to 12 and carry credits aggregating 60 semester hours or five full years' work. Course 11 is a general introductory one of 5 "hours," (one semester) open without other restrictions than the University entrance requirements, to all matriculated students. Zoology 10 is a similar introductory course of 5 "hours" and these together, or their equivalent, one year of biological work, constitute a minimum pre-requisite for minor graduate registration. Courses 1 to 10 are therefore open to graduates as minor subjects. Courses 1 and 2, following 11, cover one year, and these or their equivalent are required for major graduate credit. Courses 3 to 10 inclusive may be approved, with any additions specified in individual cases, for major graduate work towards a master's degree. Registration for a doctor's degree may be accepted on the same basis, but in this case study must be so specialized as early to permit effective research. Those having sufficient preparation will be enrolled at once for major work in one or more of the courses marked for graduates. These are research courses and the work is adapted to the special purposes or requirements of each investigator.

The collections in the Herbarium are in convenient order for reference and include materials for research in several

subjects. Of fungi there are over 30,000 mounted specimens together with a large amount of duplicate material.

3. Cytology and Physiology. — Mostly laboratory work and assigned reading. The course extends through the year, but the work of each semester may be credited separately under the designations of 3a and 3b. The first semester is devoted mainly to cytology and histology, with special attention to technique; during the second semester experimental physiology receives chief attention. I., II.; 3, 4: (5). Assistant Professor Hottes.

Required: Botany 1.

4. Taxonomy of Special Groups. — Mostly laboratory and herbarium work, and assigned reading. Field excursions are required. The course extends through the year, but the work of each semester may be credited separately under the designations of 4a and 4b. The first semester is devoted mainly to spermaphytes, the second to sporophytes. I., II.; 1, 2; (5). Professor Burrill.

Required: Botany 2.

5. Bacteriology. — An introduction to the knowledge of the subject and instruction in methods. II.; 3, 4; (5). Professor Burrill and Miss Latzer.

Required: Chemistry 1, and at least one semester's work in botany or zoology, in the University.

7. Plant Pathology. — Diseases and injuries of plants. Mostly laboratory, herbarium, and field work, and assigned reading. I.; M., W., F; 1, 2; (3). Professor Burrill.

Required: Botany 1, 2.

9. Investigations and Thesis. — Research work upon selected subjects. Special arrangements for this work should be made during the preceding year. I., II.; *arrange time*; (5). Professor Burrill and Assistant Professor Hottes.

Required: Botany 1, 2, and at least one year from 3, 4, 5, 7.

10. Seminary. —Reports and discussions upon assigned topics and results of research work. For advanced and graduate students. I. II.; F.; *arrange time.* (1). Professor Burrill.

COURSES FOR GRADUATES

101. Biological Botany. — The preparation and study of material by histological and embryological methods, and exper-

iment work with living vegetation in the laboratory and field in working out special problems in the development, physiology, and pathology of plants. Assistant Professor HOTTES.

102. SYSTEMATIC BOTANY. — Critical and comparative studies of species included in chosen groups of spermaphytes or sporophytes, or from selected geographic areas, in connection with considerations of genealogic development, geographic distribution, and interrelated association. Professor BURRILL.

103. BACTERIOLOGY. — Investigations upon morphologic and physiologic variation due to treatment; systematic studies upon the number, validity, and relationship of species, researches upon special saprophytic or parasitic kinds of bacteria and upon methods of favoring or combating their activities. Professor BURRILL.

104. EVOLUTION OF PLANTS. — Observations and experiments upon plants and studies in related literature, in gaining information upon such topics as the following: The influence of environment, effects of self and cross fertilization, tendencies of variation, philosophy of selection, nature and laws of heredity. Professor BURRILL and Assistant Professor HOTTES.

CHEMISTRY

Special opportunities and facilities are afforded properly prepared students, to undertake graduate work in all lines of pure and applied chemistry. The commodious, new chemical building, with its large laboratories and separate research rooms is well equipped for graduate work in inorganic, organic, physical, agricultural, and applied chemistry. In combination with certain engineering courses special facilities are available to students wishing to do graduate work in electro-chemistry and in chemical engineering. The requirement for major graduate work in the Departments of Chemistry is the baccalaureate degree of this University or its full equivalent.

COURSES FOR GRADUATES

101. ORGANIC CHEMISTRY. — Special investigations in the aliphatic or in the aromatic series. Associate Professor GRINDLEY and Dr. DEHN.

102. Inorganic Chemistry. — Research work in general inorganic chemistry, including the critical and constructive study of methods of analysis, both quantitative and qualitative. Professor Parr, Associate Professor Grindley, and Dr. Lincoln.

103. Physical Chemistry.— Investigation of special problems, including thermo-chemical research. Dr. Lincoln.

104. Chemistry of Foods. — Investigations of the composition, fuel value, digestibility, and dietary value of foods, and the chemical changes involved in cooking. Associate Professor Grindley.

105. Agricultural Chemistry. — Special investigations in the field of agricultural chemistry, including the chemistry of plants, foods, soils, and rain, drain, and ground waters. Associate Professor Grindley and——

106. Research in Metallurgical Chemistry.—(a) Action of solvents in extraction of gold and silver from their ores. (b) Methods of analysis of ores and products. Professor Parr.

107. Investigation of Water Supplies.— In connection with State Water Survey. Mr. Stark.

108. Investigation of Fuels—

(a) Heating power, calorimetric methods.

(b) Adaptation of bituminous coal to gas manufacture, purification of products.

(c) Coke and by-products.

Professor Parr.

109. Special Problems in Industrial Chemistry.—

(a) Corrosion and scaling of steam boilers.

(b) Purification of feed water.

(c) Cements and mortars.

(d) Paints and pigments.

Professor Parr.

GEOLOGY

The undergraduate courses offered in this department cover a wide field. Each of the semester courses, mineralogy (Geol. 5), general geology as taken by chemists, or as taken by general science students (Geol. 1), agricultural geology (Geol. 12), engineering geology (Geol. 13), or physical geography (Geol. 8), looks toward, and is pre-

paratory for a different line of advanced work. The equipment of the department enables us to offer excellent facilities for advanced study along each of these lines.

To the agriculturist there is offered studies in the mineralogical composition of soils carried on by the use of the microscope and other optical agencies; in mineral and rock decomposition; and in meteorology: to the engineer and chemist, studies in the characteristics, origin and methods of deposition of all useful minerals, together with the uses which are made of them; in the testing of mineral substances used in the manufacture of structural materials, by physical methods; in mineral synthesis; and in petrography; to the biologist, studies in paleontology, using our unusually large collection of paleozoic forms; in organic evolution from the standpoint of the geologist; and in the distribution of organisms as affected by geographic influences: to the teacher, studies in the geology and physical geography of selected regions with special reference to their influence on the welfare of mankind; and of methods for observational and laboratory work in these subjects which are best adapted to the needs of students in secondary schools: to the student of general science such selection from the above as will best promote the object he has in view.

At least one semester of apporpriate introductory work, as offered in University courses, or the equivalent, is required for graduate registration. The courses open to undergraduates may be taken for minor graduate credit, or with approved additions, for major work.

2. Economic Geology.—A study of the uses man may make of geologic materials; of the conditions under which they occur, and those under which they were formed; and of the qualities which make them valuable. Readings, conferences, and laboratory work.

Each student may select one or more of the subjects indicated below and devote so much time to it as may seem desirable or profitable. The proportion of time devoted to reading, conference and laboratory will of course vary with the nature of the subject chosen. The laboratory affords facilities for making the work thoroughly practical.

Ores and ore deposits, useful minerals other than ores, mineral synthesis, petrographic studies, properties of clays which fit them for various uses, properties of lime and cement-making materials; properties of building stones; rock-flours and their uses, origin, and uses of road metals, studies of ornamental stones, coals and coal basins, hydrographic studies, etc., either, or both semesters, (2, 3, or 5). Professor WOLFE, Mr. FOX, and Mr. MATSON.

4. INVESTIGATIONS.—Students desiring to take advanced work in any department of dynamic or historical geology, in mineralogy or in physical geography may, with approval, select a subject for investigation and receive such guidance and help as may be necessary. Readings, conferences, laboratory and field work are apportioned according to the nature of the subject. The work is individual, and the student is expected to show results. Either semester: (3 or 5). Professor ROLFE, Mr. FOX, and Mr. MATSON.

6. ADVANCED CRYSTALLOGRAPHY.—During the first part of the semester a detailed study of the forms of crystals, their combinations and abnormalties is made. Later the student learns to measure the facial angles of crystals with the contact and reflecting goniometers and by mathematical calculations to determine the species. I. Tu., Th.; 3-4; (2). Professor ROLFE, and Mr. FOX.

7. OPTICAL MINERALOGY.—The student is first made acquainted with the peculiarities of the petrographic microscope, and of the behavior of minerals in thin section in parallel and convergent light. He then places thin sections of minerals and rocks under the microscope and learns to determine their species and the changes which are taking place in them by their effect on transmitted light. I.; M., W., F. 3-4; (3). Professor ROLFE, and Mr. FOX.

9. ADVANCED PALEONTOLOGY.—This course includes (a) discussion of the biological relations of fossils form along the lines

indicated in Williams' Geological Biology: (b) discussion of the principles of classification as applied to fossils, together with the characteristics which distinguish the larger groups, using Nicholsom, Bernard, and Zitti as guides; (c) study of the distribution and variations of the genera and species of one or more of the important groups as illustrated by the collections of the University. Either semester; 3-4; (5). Professor ROLFE, Mr. FOX, and Mr. MATSON.

10. TEACHER'S COURSES IN PHYSICAL GEOGRAPHY.— This course is designed primarily for those who expect to teach. The work includes discussions of the most approved methods of presenting each topic in class room, field, and laboratory, and the use which can be made of local geography, topography and geology together with the fauna and flora as illustrative material. It also includes the selection of topographic sheets issued by the United States Geological Survey which show well developed topographic types, and their proper use in the class room; the manufacture and use of models and all other means by which the principles of the science may be experimentally studied. It further includes observations on character of cloud, direction and velocity of wind, temperature and humidity of the air, and their relation to weather changes; the study of weather maps, and the constitution and use of simple apparatus for meteorological observations. A study is made of the geographic elements which have combined to produce the peculiarities of surface and climate of selected regions and the effect which these combinations have had on the historical, commercial and industrial progress of their inhabitants. I.; *arrange time.* (5). Professor ROLFE, and Mr. MATSON.

COURSES FOR GRADUATES

102. ECONOMIC GEOLOGY.— The laboratories afford facilities for the study of problems in economic geology by the most approved methods. These problems may be approached from the geological side only in the laboratories of the department, or may be carried on under the joint direction of the departments of geology and applied chemistry. Again they may be purely laboratory problems, or the student may make an economic survey of some assigned area.

104. DYNAMIC GEOLOGY.—The dynamic problems in Illinois geology have scarcely been touched except on the glacial side.

There are many problems in stream work, pre-glacial drainage, tracing moraines of Illinois glaciation, water supply, peneplanation, deserted lake beds, the Ozark ridge, etc., that await solution. The University offers excellent facilities for work along these lines.

108. PHYSICAL GEOGRAPHY.—Studies in the geography of Illinois dealing with the topography, meteorology, climatology, and natural products of assigned areas.

HOUSEHOLD SCIENCE

The University affords unusual facilities for advanced work in this department. The equipment of the department has been carefully selected and much illustrative material has been secured. In addition to the laboratories of the department, the resources of the library, the investigations of the well equipped science laboratories, the researches of the department of economics, are available for the use of the student.

At least one year of acceptable household science work is required for graduate registration. Courses open to undergraduates will have additions for graduate credit.

COURCES FOR ADVANCED UNDERGRADUATES AND GRADUATES

4. CHEMISTRY OF FOOD AND NUTRITION.—Food and nutrition from the standpoint of sanitary and physiological chemistry. Investigations in the study of yeasts; household applications of bacteriology; dietaries adapted to different ages, occupations and conditions. *Richard and Woodman's Air, Water, and Food; Halliburton's Essentials of Chemical Physiology; Government Bulletins.* I.; M., W.; 3., 4.; Tu., Th., F.; 3; (5). Professor BEVIER.

Required: Bot. 5. Chem. 1, 3b, 4, 5c, 20; 5 hours in Botany or Zoology.

5. DIETETICS AND HOUSEHOLD MANAGEMENT.—The topics considered are: (a) the principles of diet; the relation of food to health; the influence of age, sex and occupation; the dietic treatment of certain diseases; principles of home nursing. (b) The organization and care or the household; the processes involved in the cleaning of metals, woods, and fabrics; the use of disinfectants. II.; M., W., F.; 5; (3). Miss BEATTY.

Required: Household Science 1, 6.

6. Economic Uses of Food.—This course is a continuation of course 1. Emphasis is put upon the economic side of the food question. The uses and applications of preservatives are considered. I.; M., W., F.; 1, 2: (3). Miss Beatty.

Required: Household Science 1.

8. Personal and Public Hygiene.—This course is intended to be a popular presentation of the results of late investigations in regard to food and sanitation. II.; Tu.; 7; (1). Professor Bevier.

9. Seminary.—Reports and discussions upon assigned topics. For advanced students. I., II.; W.; *arrange time*; (1) Professor Bevier.

101. Home Economics.—A study of the origin and development of Home Economics in its various phases. Particular attention is given to its industrial, educational and sociological aspects. Professor Bevier.

102. Special Investigations.—Problems in the application of the principles of bacteriology, chemistry and physiology to the ordinary processes used in the preparation of food. Professor Bevier and Mrs. Sober.

MATHEMATICS

The University offers an opportunity for pursuing graduate work in mathematics for two or three years. The minimum requirement for entering upon this work includes three years of undergraduate study in the same line. It is recommended that students anticipating graduate work at this University shall take, in addition to the above requirements in mathematics, a year of experimental physics and when possible a half year in mechanics. Students making their major in mathematics may with profit elect at least one of their minors from the allied subjects in engineering, physics, or astronomy.

The University Library contains complete sets of the leading French, German, English, and American mathematical journals. It also contains the most important collected works and treatises, particularly in the line of theory of functions and in geometry. The department is

supplied with a collection of models for use in geometry and in the theory of functions. Research work in these two lines is amply provided for. In connection with the preparation of a thesis, all graduate students in mathematics are required to be members of the mathematical seminar (Math. 15) where the results of their investigations are presented and discussed.

Aside from the following courses, which are regularly offered to advanced undergraduates, work will be given in continuous groups, and definite integrals, if the demand for these subjects seems to warrant it.

12. Theory of Invariants.—The general development of the theory of invariants, both from the geometric and from the algebraic side. Applications of invariants to systems of conics and higher plain curves. I.; M., W., F.; 7; (3). Dr. Rietz.

Required: Mathematics 8b (or 9), 11.

13a. Functions of Real Variables.—The two courses in functions (13a , 13b) are a continuation of the work done in calculus (8a, 8b, or 7, 9). Under functions of real variables, considerable attention is given to the fundamental ideas of the analysis, including rational and irrational numbers, mengelehre, single and double limits and their application to questions of continuity of functions of one and two variables, uniform convergence of series, etc. The existence of derivities, condensation of singularities, definite integrals, differentiation and integration of series are also discussed. I., II.; M., W., F.; 8; (3). Associate Professor Townsend.

Required: Mathematics 8a, 8b, (or 7, 9,) 10.

13b. Functions of a Complex Variable.—A general introduction to the theory of functions of a complex variable. The methods of Weierstrass and Riemann are followed. I., II.; M., W., F.; 8; (3). Associate Professor Townsend.

Required: Mathematics 8a, 8b (or 7, 9,) 10.

14. Method of Least Squares.—The fundamental principles of the subject. The following subjects are studied: Law of probability and error, adjustment of observations, precision of observations, independent and conditional observations, etc. I.; Tu., Th.; 6; (2). Dr. Stebbins.

Required: Mathematics 8a, or 9.

15. Seminary and Thesis.—I., II.; Tu., Th.; 8; (3). Associate Professor Townsend.

18. Higher Plane Curves.—This course includes the general theory of algebraic curves, together with the application of the theory of invariants to higher plane curves. Special study is made of curves of the third and fourth order. II.; M., W., F.; 7; (3). Dr. Rietz.

Required: Mathematics 12.

20. Calculus of Variations.—This course has for its aim merely to acquaint the student with those elements of the science which are most needed in the study of the higher subjects of mathematical astronomy and physics. II.; M., W., F.; 4; (3). Professor Shattuck.

Required: Mathematics 11, 16.

21. Spherical Harmonics.—This course is introduced by a short course of lectures and study of certain trigonometric series. Fourier's Theorem for developing any function of a variable in a series proceeding in sines and cosines of multiples of the variable is derived and the limitations of its validity investigated. This is followed by the study of Lagrange's, Laplace's, and Lamé's functions and their applications to astronomical and physical problem. I.; M., W., F.; 6; (3). Assistant Professor Hall or Mr. Brenke.

Required: Mathematics 11, 14, 16.

22. Potential Function.—The potential function is defined and its properties derived and discussed. The potential of various bodies, such as wire, a spherical shell, a sphere, ellipsoid of revolution, etc., is computed. Poisson's and Laplace's Equations are derived and discussed. Green's propositions with kindred and similar subjects are considered. II.; M., W., F.; 6; (3). Assistant Professor Hall or Mr. Brenke.

Required: Mathematics 21.

23. Modern Geometry.—This course includes, in general, a consideration of homogeneous coordinates, duality, descriptive and metrical properties of curves, anharmonic ratios, homography, involution, projection, theory of correspondence, etc. I.; M., W., F.; 7; (3). Mr. Coar.

Required: Mathematics 8a or 7, 11.

24. Algebraic Surfaces.—In this course are considered the

application of homogeneous coordinates and the theory of invariants to geometry of three dimensions, and also the general theory of surfaces, together with the special properties of surfaces of the third and fourth order. II.; M., W., F.; 7; (3). Mr. Coar.

Required: Mathematics 17, 18.

25. Partial Differential Equations.—It deals with the integration and determination of the integration constants of such partial differential equations as arise in the study of such subjects as the flow of heat, the vibration of strings, plates, etc., and electricity. II.; Tu., Th.; 7; (2). Associate Professor Townsend.

Required: Mathematics 8a or 9, 16.

PHYSICS

The advanced work in physics is both experimental and theoretical. The Physics Laboratory is equipped with the necessities and conveniences for experimental work. In addition to the large lecture and laboratory rooms arranged for the elementary undergraduate courses, a large space on the first floor is conveniently divided into rooms for advanced experimental work. These include six rooms with heavy masonry piers, a constant temperature room, a chemical preparation room, three rooms for spectrum, photometric and photographic work, and a well-equipped machine shop. The cabinets of the department contain fine standard apparatus from the best makers for work in the various branches of physics. The equipment for work in heat and in electricity and magnetism is especially strong, much new apparatus having been added recently. The services of a mechanician give means of constructing special apparatus needed for investigational work of graduate students and instructors. The literature of physics is also available, as the University Library contains not only the standard treatises and manuals of reference, but also sets of practically all of the English, French, and German journals in physics and the cognate subjects of chemtry and mathematics.

One year of University physics, including laboratory courses, and corresponding training in mathematics or chemistry, will ordinarily be accepted for admittance to graduate work in physics. Courses open to undergraduates will have additions for graduate credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

5. ADVANCED EXPERIMENTAL PHYSICS.—This includes the following separate courses: (5a) Mechanics; (5b) Light; (5c) Electricity and Magnetism; (5d) Heat. Each course I. or II. semester; *time to be arranged*; credit to be 2, 3, or 5 hours. Professor CARMEN and Assistant Professor KNIPP.

5. THEORETICAL PHYSICS.—This includes five courses on the elementary mathematical theory of physics. A knowledge of the elementary methods of the calculus is desired. (6a) Mechanics; (6b) Light (Preston's light); (6c) Electricity and Magnetism (Thomson's Elementary Mathematical Theory); (6d) Heat (Preston's Heat): (6e) fluids. Each course 3 or 5 hours' credit. *Semester and hours to be arranged.* Professor CARMEN, Assistant Professor KNIPP, and Dr. WATSON.

7. INVESTIGATION OF SPECIAL PROBLEMS.—I. and II.; *time to be arranged*; 3 or 5 hours' credit. Professor CARMEN, Assistant Professor KNIPP, and Dr. WATSON.

8. MATHEMATICAL PHYSICS.—*Semester and hours to be arranged*; 3 or 5 hours' credit. Professor CARMEN.

COURSES FOR GRADUATES

101. ADVANCED PHYSICAL MEASUREMENTS AND INVESTIGATION.—This is work in advance of courses 5 and includes the experimental work in preparation of a thesis. *Both semesters, with hours and credit to be arranged.* Professor CARMEN, Assistant Professor KNIPP, and Dr. WATSON.

102. MATHEMATICAL PHYSICS.—*Work and hours to be arranged.* Professor CARMEN.

103. MATHEMATICAL THEORY OF ELECTRICITY AND MAGNETISM FOR ENGINEERS. Professor Carmen and Assistant Professor KNIPP.

PHYSIOLOGY

The equipment of the laboratory includes a considerable number of instruments of precision giving facilities of

research along certain lines as good as can be found in the country. Graduates interested in certain problems, especially such as are connected with the blood and its circulation and respiration, may profitably spend one or more years in advanced investigations, in or beyond courses described below.

Registration for major credit requires at least one year of undergraduate work in the subject, viz., course 1, or an equivalent; but for those who have the requisite training in chemistry, physics, and zoology any of the courses 1, 2, 3, or 5 may be accepted for minor credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

2. ADVANCED COURSE.—Continuation of Physiology 1 through a second year. This course is designed for students who wish to get as thorough a training as possible for the study of medicine, and who can afford to take the full science course at the University leading to the B. S. degree. Lectures, assigned reading, and experiments in the laboratory conducted by the students under the supervision of the instructor. I., II.; *daily* 3, 4; (5). Professor KEMP.

3. INVESTIGATION AND THESIS.—Every facility and encouragement, so far as the resources of the laboratory permit, are offered to those prepared to avail themselves of these for researches leading to theses for the bachelor's, master's or doctor's degree, or for carrying on original work for publications.

4. MINOR COURSE.—Especial emphasis is laid upon those facts that serve as a basin for practical hygiene, and for helping students to teach physiology in high schools. Lecture demonstrations, recitations, and laboratory work. Students who have had chemistry and zoology in high schools may be admitted to the course at the option of the instructor. II.; *daily*; 7, 8; (5). Professor KEMP.

Required: Chemistry 1, zoology 10.

5. SPECIAL PHYSIOLOGY.—There are here included the following lines of laboratory work, any one or more of which may be pursued independently of the others: (a) The physiology of foods, and digestion; (b) the blood, circulation, and respiration;

(c) the excretions, especially urine analysis; (d) general physiology of nerve and muscle; (e) advanced vertebrate, especially human, histology. This course may be taken after physiology 4, and is recommended for those who wish to work a year in physiology without having the requirements to enter the class in physiology 1. It may also be taken for less than five credits. Work to be arranged after consultation with Professor KEMP.

ZOOLOGY

Zoology may be taken as a graduate minor by a student who has taken the introductory courses in zoology and botany (zoology 10 and botany 11), which together make one year's work. It may be taken as a graduate major by one who has taken zoology 10 or its equivalent followed by course 1 (invertebrate zoology) or course 2 (vertebrate zoology and comparative anatomy), one year's college work in all.

The courses hereinafter described may be taken as minors or majors for either the master's or the doctor's degree. For the master's degree any one of courses 1 to 9, and 12 to 17 of this list may be counted as a minor, and any series of these courses amounting to ten semester hours may be taken as a major. Whether or not a research course followed by a thesis will be required for the master's degree will depend, in each case, on the undergraduate work of the candidate, and the approval of the University Committee on the Graduate School. The course leading to the doctor's degree with zoology as a major should comprise, as a rule, all the above courses, together with a research course of at least one year, the results of which are to be embodied in the dissertation. A selection of minor courses should be made with reference to the candidate's previous studies, and will be subject to the approval of the committee on the Graduate School.

Graduate students in this department have access to the important and extensive special libraries and eollcctions

of the State Laboratory of Natural History, housed in the Natural History Building.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

1. INVERTEBRATE ZOOLOGY.—This course is largely given to the study of common invertebrate animals of Illinois, with special attention to their distribution, habits, life histories, and adaptive structures. A few type forms are studied additional to those of the elementary course. Field work and its methods are included in the course, the work of which is adapted throughout to the needs of prospective teachers. I.; lecture, M., W., F.; 4; laboratory, 7 periods; 3 and 4; (5). Professor FORBES and Dr. PETERS.

Required: Art and Design 1; an entrance credit in chemistry or chemistry 1; zoology 10.

2. VERTEBRATE ZOOLOGY AND COMPARATIVE ANATOMY.—In the laboratory work of this course principal attention will be given to the anatomy of Necturus and to anatomical and systematic studies of fishes, birds, and mammals, especial reference being had to the anatomy of man. The more difficult parts of laboratory technology will be given in this course, which will also contain lectures on the general theory of organic development as illustrated by the doctrine of the descent of man. I.; lecture, M., W., F.; 4; laboratory, 7 periods; *arrange time*; (5). Assistant Professor SMITH and Dr. PETERS.

Required: The same as for zoology 1.

3. VERTEBRATE EMBRYOLOGY.—This course begins with a study of the sex cells and a discussion of theories of heredity, followed by a consideration of the early stages in the development of the egg. The formation of the vertebrate body is then studied in the amphibian, the chick, and the pig. Instruction is given in the preparation of embryological material and in graphic reconstruction from serial sections. II.; 3, 4. (5). Dr. PETERS.

Required: Zoology 2.

15. VARIATION AND HEREDITY.—A course of lectures and reference reading designed to give a general survey of the results obtained by the application of modern statistical methods in the study of variation and heredity. A knowledge of the methods is acquired from lectures and from exercises in handling data gathered from various sources. Mendel's principles and the theory

of mutations are discussed. For accompanying laboratory work see 15a. II.; *arrange time*; (2). Assistant Professor SMITH.

Required: Zoology 10 or 11.

15a. STATISTICAL DATA.—Laboratory work involving the collection of data suitable for a study of the variations and correlations of structures in some suitable organism may be elected in connection with course 5. The extensive collections of insects, fishes, and plankton material in the possession of the state Laboratory of Natural History are available for the purposes of this course. II.; *arrange time*; (1 to 3).

Required: Zoology 10 or 11.

17. FIELD ZOOLOGY.—A course in which the main object will be to gain as comprehensive a knowledge as practicable of the animal life of a restricted locality. Collection, preservation, and identification of the various kinds of animals, together with observations on the habits, life histories, and relations to environment of selected forms will constitute the major part of the work. The phases of the subject receiving most attention will vary with the make-up of the class and with the kind of locality selected, but in any event the work will be so planned as to make it a desirable course for prospective teachers of zoology. The organization and management of the work will be such that graduate students intending to work subsequently on special groups, as plankton forms, annelids, or fishes, can give especial attention to such groups, if found desirable. II.; *arrange time*; (3). Assistant Professor SMITH.

Required: Zoology 10 or 11, and 1 or 2.

8. THESIS INVESTIGATION.—Candidates for graduation who select a zoological subject as a thesis are required to spend three hours a day during their senior year in making a detailed investigation of the selected topics. While this work is done under the general supervision of an instructor, it is in its methods and responsibilities essentially original work. I., II.; *arrange time*; (5). Professor FORBES and Assistant Professor SMITH.

Required: Two years in zoological courses, including one semester of zoology 4.

12. STATISTICAL ZOOLOGY.—This course is offered for students taking mathematics 26. It includes lectures and reference reading on the application of statistical methods to biological problems. The history of the development of this mode of biological investigation, the nature of the problems to which it is applicable

and some of the results already obtained in the study of variations, heredity, distribution and phylogeny are among the topics considered. Students taking this course, together with mathematics 26b, ordinarily use for the problems of the latter course, zoological data that have been obtained either by their own observations or from other sources. If desired the combined credits of this course and mathematics 26 may be counted as 5 credits either in zoology or in mathematics. II.; F.; 7; (1 or 5). Assistant Professor SMITH.

Required: Mathematics 2, 4, 6, 8a, and at least ten hours of University work in zoology, or in zoology and entomology.

14. GERMAN READINGS.—A study of zoological literature in German intended to give technical information and practice of accurate and rapid reading. This course, together with botany 13, will be accepted instead of German 6 of the prescribed list of all except students in chemistry and chemical engineering. I., II.; *arrange time*; (2). Assistant Professor HOTTES.

Required: German 4.

COURSES FOR GRADUATES

101. PLANKTON ZOOLOGY.—Instruction and practice will be given in modern methods of studying minute forms of aquatic life with the aid of a plankton apparatus and laboratory equipment. This work includes both a qualitative and a quantitative investigation of the minute zoological contents of a selected body of water, carried on systematically through a considerable period, and the generalization of the results of such study by the methods peculiar to the planktologist.

102. FRESH-WATER ICHTHYOLOGY.—The large collections of fishes belonging to the University and the State Laboratory of Natural History, together with the ichthyological library of the latter, are open to students who wish to become acquainted with the ichthyological of a fresh-water situation. Both qualitative and quantitative studies of the fishes of a selected body of water are made, and papers written presenting the results of personal studies in this field.

103. FRESH-WATER AND TERRESTRIAL ANNELIDS.—This is an application of the methods of the zoological laboratory to the study of the annelid worms of the land and the inland waters of North America. The description of genera and species, practice in drawing for publication, and experimental work on the physiology and ecology of selected forms will be included in this course

SUJBECTS OF THE COLLEGE OF AGRICULTURE

AGRONOMY

The instruction offered in the department of agronomy covers the subjects of soil fertility, soil physics, soil bacteriology, crop production, plant breeding, and farm mechanics. The department is also conducting extensive investigations relating to soils and crops. A considerable number of advanced students are employed during the summer season in connection with soil fertility investigations, the detail survey of Illinois soils, experimentation with corn and other field crops, etc., their time being devoted to study during the winter season.

The facilities for graduate work include an analytical laboratory for analyzing soils, crops, and plant food materials, extensive greenhouses erected specifically for studying soil fertility by pot cultures, well equipped and commodious laboratories for the study of soil physics, soil bacteriology, plant breeding and seed testing. Aside from the large number of experiment fields which are located in many different parts of the state, the department is conducting extensive field experiments covering about one hundred acres of land on the University farm at Urbana, some of which have been in progress for nearly thirty years. Besides these regular Experiment Station fields, which are made use of in giving instruction, there are certain fields which are reserved for student experiments.

Good instruments are provided for surveying lands in working out systems of tile drainage, and two large laboratories (40 by 116 feet each) are well equipped with the various kinds of farm implements including field machinery, windmills, power spraying machines, gas engines, and other power machines and hand tools used on the

farm. Many students taking advanced work in farm mechanics are employed during the summer season as machinery experts by different harvesting machine companies. For registration in major graduate work at least two years' undergraduate study in agronomy and the requisite special preparation is required.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

7. Special Crops.— A special study of farm crops taken up under an agricultural outline—grain crops, root crops, forage crops, sugar and fiber crops—their history and distribution over the earth, methods of culture, cost of production, consumption of products and residues, or by-products. Class work supplemented by practical field work and a study of the results of previous experiments, such as detasseling corn, injury to roots of corn by cultivation; selection of seeds of farm crops; special reference to Illinois conditions. II.; *daily*; 3, 4.; (5). Mr. Hume.

Required: Agronomy 2, 5, 6.

8. Field Experiments.—Special work by the students, conducted in the field. This work consists in testing varieties of corn, oats, wheat, potatoes, and other farm crops; methods of planting corn, seeding grains, grasses, and other forage crops; culture of corn, potatoes, and sugar beats; practice in treating oats and wheat for smut, and potatoes for scab, and studying the effects upon the crops; combating chinch bugs and other injurious insects. Other practical experiments may be arranged with the instructor. Special opportunities will be given to advanced students of high class standing to take up experiments, under assignment and direction of the instructor in crop production, on certain large farms in the state, arrangements having been made with farm owners or managers for such experiments. II.; *second half, and summer vacation*; *daily; arrange time* (2½–5). Mr. Hume.

Required: Agronomy 7, 12.

10. Special Problems in Soil Physics.—This work is intended for students wishing to specialize in the study of the physical properties of soils, and includes the determination by electrical methods of the temperature, moisture, and soluble salt content, of various soils under actual field conditions; effect of different depths of plowing, cultivation, and rolling, on soil

conditions; effects of different methods of preparing seed beds; the physical questions involved in the formation and redemption of the so-called "alkali," "barren" or "dead dog" soils, and of other peculiar soils of Illinois. . II.; *or summer vacation; daily; arrange time*; (2 to 5). Mr. Mosier.

Required: Agronomy 9, and one semester's work in geology.

13. Investigation of the Fertility of Special Soils.—This course is primarily designed to enable the student to study the fertility of those special soils in which he may be particularly interested, and to become familiar with the correct principles and methods of such investigations. It will include the determination of the nature and quality of the elements of fertility in the soils investigated, the effect upon various crops of different fertilizers added to the soils as determined by pot cultures, and, where possible, by plot experiments. This work will be supplemented by a systematic study of the work of experiment stations and experimenters along these lines of investigation. I., II.; *arrange time*; (2 to 5). Professor Hopkins.

Required: Agronomy 12.

16. German Agricultural Readings.—A study of the latest agricultural experiments and investigations published in the German language, special attention being given to soils and crops. The current numbers of German journals of agricultural science will be required and used as a text. This course is designed to give the student a broader knowledge of the recent advances in scientific agriculture, and, incidentally, it will aid him in making a practical application of a foreign language. It is recommended that it be taken after agronomy 12. II.; M., W.; 4; (2). Professor Hopkins.

Required: Two years' work in German.

17. Special Work in Farm Mechanics.—Students may arrange for special work in any of the lines covering drainage or farm machinery, either in second semester or the summer. (2½–5). Mr. Crane.

COURSES FOR GRADUATES

101. Systems of Soil Investigation; Sources of Error and Methods of Control, Interpretation of Results. Professor Hopkins.

102. The World's Supply of Plant Food Materials, Including Methods of Utilization. Professor Hopkins.

103. Different Systems of Agricultural Practice and their Ultimate Effect Upon the Soil. Professor Hopkins.

104. Drainage Waters; Surface and Sub-Drainage, with Special Reference to Soil Fertility. Professor Hopkins.

105. Detailed Study of Soil Investigations in Progress in Illinois. Professor Hopkins.

106. Soil Types; Methods of Surveying and Mapping.—The work may include field practice. Mr. Mosier.

107. Erosion of Soils by Surface Washing and Methods of Prevention. Mr. Mosier.

108. The Mechanical Composition of Soils; its Influence Upon Granulation, Absorption and Retention of Moisture, and Other Physical Properties Effecting Crop Production. Mr. Mosier.

109. Experimentation in the Production of Field Crops.—The work may include actual practice in planning and conducting field experiments. Mr. Hume.

110. Weeds: Advanced Study and Investigation Relating to their Distribution, Identification, aud Methods of Eradication, and Prevention of Dissemination. Mr. Hume.

111. The Selection of Seeds; Methods of Determining Quality. Mr. Hume.

112. Plant Breeding, Including a Detailed Study of Experiments at this Station, and of Methods and Results Reported From Other States and From Foreign Countries. Mr. Smith.

113. Machine Designing; Advanced Study of Farm Implements with Special Reference to Possible Improvements. Mr. Crane.

ANIMAL HUSBANDRY

Work is constantly in progress in the various branches of animal husbandry at the Experiment Station, and ample opportunities are offered graduate students desiring to take part in these investigations. The department has well chosen representations of all the most prominent breeds of livestock, has special facility for investigations pertain-

ing to food stuffs and nutrition, and for the study of results in the production of meats. Opportunities are offered for advanced studies in various problems of breeds and breeding for which the department is supplied with the requisite literature and illustrative material. At least two years of undergraduate study in the general subject is required for major graduate work.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

7. PRINCIPLES OF STOCK FEEDING.—The functional activities of the animal body and the end products of their metabolism. Foods are considered first chemically, as affording materials for the construction of the body tissues or of animal products, as meat, milk, wool, etc.; second, dynamically, as supplying the potential energy for the body processes and for external labor; third, as to the fertilizing value of their residues. I,; *first half; daily*; 3; (2½). Professor MUMFORD.

Required: Chemistry 1, 3b, 4, 13; entrance physics or its equivalent and one year of botany or zoology.

12. BREEDS OF BEEF CATTLE.— The history, development, and characteristics of the breeds suitable for beef production. Tracing pedigrees and a critical study of the same. (This course is intended for students expecting to own or manage pure bred herds.) Lectures, assigned readings, and exhaustive practice in judging. I.; *first half; Lectures*, M., W., F., 6; *Laboratory or practical exercises in judging*, Tu., Th.; 6, 7; (2½). Professor MUMFORD.

Required: Animal Husbandry 10, 11.

14. MANAGEMENT OF PURE-BRED HERDS OF BEEF CATTLE. Like animal husbandry 3, this course is intended for students anticipating the management or ownership of registered herds, The breeding herd, and its housing, feed and management. The selection and fitting of animals for sale and for the show ring. Disposal of surplus stock. Lectures and assigned readings. I.; *second half; daily*; 6; (2½). Professor MUMFORD.

Required: Animal Husbandry 10, 11, 12, and 13.

17. THE EDUCATION AND DRIVING OF THE HORSE.—A critical study of the mental qualities, peculiarities, and limitations of the horse, together with the most successful methods of educating and training him for skillful work at labor or on the road. The rules and practices of correct driving; the responsibilities of

the driver and the courtesies of the public highway. Lectures, readings, and practice. II.; *second half*; *daily*; 6, 7; (3).

COURSES FOR GRADUATES

101. Development of Type in Domestic Animals.—A study of the various factors and conditions involved in the development of type and characteristics in the breeds and strains of cattle, horses, sheep and swine, and the bearing of these factors and conditions upon future improvement. Professor Mumford.

102. Animal Nutrition,—Advanced work in the principles of nutrition as bearing upon the feeding of animals. Special investigations at the Experiment Station, also special study of records of investigations and feeding experiments of the department with reference to problems of nutrition. Professor Mumford.

103. Live Stock Experimentation. — Objects, methods, and sources of error in experimental work dealing with the feeding, breeding and management of farm animals. Detailed study of live stock experiments in progress at this station, and a survey of past and present work in this line by the various experiment stations of the world. Professor Mumford.

HORTICULTURE

Exceptional facilities for the prosecution of graduate work are offered in the Department of Horticulture. A large collection of wax models of fruits and a rapidly growing herbarium of economic and ornamental plants representing horticultural varieties as well as all the more important native and imported species furnish material for systematic work in pomology and landscape horticulture. This work is further facilitated by the large collection of apples, flowers and ornamental plants growing upon the University grounds. Opportunity is afforded for exhaustive studies in problems concerning the packing, storage and marketing of apples. Ample provision is made for research work in spraying. The greenhouses afford facilities for the study of problems in plant propagation and commercial floriculture.

At least two years of collegiate work in horticulture and

allied subjects and the requisite preparation for the chosen subjects are required for entrance upon major work in this department.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

6. NURSERY METHODS.—A study of some details of nursery management and their relation to horticulture in general. Lectures and reference readings. II.; *first half; daily;* 8, (2½) Assistant Professor CRANDALL.

Required: Horticulture 1, 5; entomology 4.

7. SPRAYING.—The theory and practice of spraying plants, embracing a study of materials and methods employed in the combating of insects and fungous diseases. Recitations, reference readings, and laboratory work. II., *second half*; *Recitations*, Tu., Th.; 6; *Laboratory*, M. W., F.; 6, 7; (2½). Mr. LLOYD.

Required: Horticulture 1, entomology 4; chemistry 1.

8. ORCHADING.—A comprehensive study of pomaceous fruits: apple, pear, quince; drupaceous or stone fruits: plum, cherry, peach, nectarine, apricot. Lectures, text-books, and laboratory work. II.; *Recitations*, M. W., F.; 6.; *Laboratory*, Tu., Th.. 6, 7; (5). Professor BLAIR.

Required: Horticulture 1; botany 1 or 11.

10. LANDSCAPE GARDENING.—Ornamental and landscape gardening, with special reference to the beautifying of home surroundings. Lectures illustrated by means of lantern slides and charts, recitations, reference readings, and practical exercises. II.; M. W., F.; 4; (3). Professor BLAIR.

Required: Two years of University work, or special preparation.

12. EVOLUTION OF CULTIVATED PLANTS.—Comprising a study of organic evolution and the modification of plants by domestication. I.; *second half; daily*, 3; (2½). Assistant Professor CRANDALL.

Required: Regular admission; two years of University work, including thremmatology.

15. COMMERCIAL FLORICULTURE.—A study of the growing of cut flowers and decorative plants. Recitations and practical exercises in the greenhouse. II.; *daily;* 3. (5). Mr. BEAL.

Required: Horticulture 4, 5; botany 2.

18. EXPERIMENTAL HORTICULTURE.—A course for those intending to engage in professional horticulture or experiment

station work. For advanced students. I.; *daily;* 1; (5). Professor BLAIR, Mr. CRANDALL, Mr. LLOYD.

Required: Regular admission: twenty hours' work in horticulture.

COURSES FOR GRADUATES

101. POMOLOGY.—Studies of special problems regarding the relationships, adaptations, improvement, propagation, cultivation, pruning, protection, preservation or marketing of orchard fruits. *Arrange time.* Professor BLAIR and Assistant Professor CRANDALL.

102. POMOLOGY. — Studies of special problems regarding the adaptations, propagation, cultivation or pruning of small fruits. *Arrange time.* Assistant Professor CRANDALL.

103. OLERICULTURE.—Studies of special problems regarding the structure, cultural requirements, seed selection and improvement of vegetables. *Arrange time.* Assistant Professor LLOYD.

104. FLORICULTURE.— Studies of the horticultural status of various flowering plants, or of special problems in the culture of greenhouse plants. *Arrange time.* Mr. BEAL.

105. LANDSCAPE HORTICULTURE.—Exhaustive studies of ornamental plants, and methods of grouping the same for the effective planting of public and private grounds. *Arrange time.* Professor BLAIR.

106. FORESTRY.—Problems in general forestry and investigadions of forest growths. *Arrange time.* Professor BURRILL.

THREMMATOLOGY

This work offered is primarily for graduate students, but it may be taken by undergraduates who have credit for thremmatology 1, or who have prosecuted extended studies in the problems of evolution.

COURSE FOR GRADUATES

101. Opportunity will be given for special studies in fundamental questions relating to the improvement of domesticated animals and plants. For this purpose there is available a liberal amount of current and standard literature, together with pedigree and other live stock records and the breeding experiments in progress in the Experiment Station. Professor DAVENPORT.

SUBJECTS OF THE COLLEGE OF ENGINEERING

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

Professor Ricker, Professor White, Professor Wells, Assistant Professor McLane, Assistant Professor Temple

A carefully chosen library of the most useful architectural works arranged in a room near the drawing rooms. The more important architectural periodicals in English, French and German. A very large and classified collection of photographs and plates from architectural journals for reference in designing. Card indexes to several American professional journals. Opportunities for experimental research in steel and concrete construction, heating and ventilation, refrigeration, etc., in the various laboratories of this College. Registration for graduate work requires a full undergraduate course in Architecture or Architectural Engineering.

COURSES FOR GRADUATES

101. Construction of Large Wooden Buildings.—Foundations, floors and ceilings, walls, roofs, economic spacing of columns, girders, beams.

102. New Uses of Stone, Brick, and Terra Cotta.—Stone columns, beams, lintels, walls, floors and ceiling; brick piers walls, vaulted ceilings, terra cotta columns, architraves, ceilings, roofs, and internal finish.

103. Steel Frame Buildings. — Foundations; cantilever girders; columns and their connections; girders, spandrels, and beams; roof frames; wind-bracing; economical spacing of columns and beams; economical planning.

104. Fire Proofing.—Systems of construction; their camparison; results of tests and of fires; defects to be remedied in ordinary fire-proofing; advantages of fire-proof structures as investments.

105. Sanitation of Public Buildings. — Plumbing and

fixtures; water supply and sewerage of city and country buildings; examinations, criticisms, and reports on examples; designs for particular cases.

106. Evolution of Architectural Styles.—Tracing the development of the column, pier, entablature, door and window, ceiling and roof; of designs and purposes of chief buildings; changes in decoration; influences of materials and climate.

107. Advanced Graphic Statics.—The kern and its uses; central ellipse or circle of inertia; uses of shear, moment, and deflection diagrams for all beams; statics of the arch, vault, dome, and of the Gothic buttress system.

108. Heating and Ventilating Systems.—Application to large groups of buildings; designs for large plants; examinations and tests of plants with reports; economics of the subject.

109. Advanced Architectural Designs.—Designing large buildings for public or private use, including construction, heating and ventilating, sanitation, lighting, with all conveniences to save time.

110. Applied Esthetics.—Theories of proportion and their application; study of average proportions in leading architectural styles; experiments in deviations.

111. Translation of a French or German Architectural Work.—Extraction of essentials; condensed translation; complete translation submitted for criticism and correction.

112. Indexing and Classification.— Indexing periodicals by Dewey decimal system; collection and arrangement of data for professional use; systems of arranging and filing papers and drawings.

113. Stereotomy.—Applications to arches, vaults, domes, and stairways, of stone, brick, terra cotta, or steel-concrete; working drawings and templates.

114. Slow-Burning Construction.—The factory mill-floor system; European systems; applications; results of tests of fires; economics of the systems.

115. Photography for Architects.—Practice in making views of exteriors, interiors, details, and of drawings; lantern

slides; printing by different processes; mounting and arrangement.

116. Copying Specifications and Drawings.—Practice in use of different methods; their advantages and defects; improvements; drawing and tracing for reproduction.

117. Advanced Perspective.— Study and application of higher French methods; lights and shadows; oblique views; reflections; abbreviated methods.

118. Specifications and Estimates for Large Buildings. Study of examples; making outlines; collection and arrangement of data; preparation of complete sets.

119. Industrial Design.—Internal wood-work of buildings; floors of parquetry, tiles of mosaics; marble-work; mantels; movable furniture.

120. Advanced Water Color Painting.—Practice in outdoor sketching; rendering elevations and perspectives in ink, sepia, color, etc.

121. Office Arrangements and Methods.—Plans of architects' offices; storage and drawings of completed work, filing contracts, specifications, tracings and prints of work in progress; forms of official papers; bookkeeping for buildings; collection of data for reference.

CIVIL ENGINEERING

Professor Baker.

The Cement Laboratory is well supplied with equipment for the study of problems relating to the structural value of cement and lime, and a Road Laboratory is in process of installation which will afford facilities for testing the road-building qualities of broken stone and gravel. Students in the Civil Engineering Department have opportunities for working in the Materials Testing and Hydraulic Laboratories, as well as in other laboratories of the University. For entrance to graduate work a full undergraduate course in Civil Engineering is required.

COURSES FOR GRADUATES

101. Location and Construction.— Advanced work in the economic theory of railway location with relation to the effects of distance, grade, and curve upon operation and maintenance. Estimates, specifications and contracts, and the improvement of existing lines of railway.

102. Railway Track and Structures, and Their Maintenance.—The design of track standards and of minor railroad structures, trestles, culverts, turn-tables, water-tanks, engine houses, etc., with special reference to economic principles of construction and maintenance.

103. Yards and Terminals.—The arrangement of tracks, buildings, etc., at division and terminal points with reference to economy and facility in handling traffic. Personal inspection and report on actual cases.

104. Motive Power and Rolling Stock.—Locomotive construction and performance, and car building and repairs.

105. Signal Engineering.—A study of the various systems of railway signaling. Personal inspections and comparisons of different plants in actual operation.

106. Railway Operation and Management.— The organization and administration of the several branches of service in railway operation.

107. Bridge Design.— A comparative study of the details of standard designs, with personal inspection of the process of manufacture and erection.

108. Cantilever and Swing Bridges.— The computation of stresses, design of parts, method of erection, etc.

109. Metallic Arches.—Computation of stresses and design of metallic arches.

110. Metallic Building Construction.—The computation and drawings of a design for a metal skeleton building, with a consideration of standard connections.

111. Roof Construction.— Computations of stresses and designs of steel roof stresses.

112. Stereotomy.

113. Theory of the Elastic Arch.

114. Water Power Development.

115. Re-enforced Concrete Construction.

116. Geodesy.—A study of the methods employed in triangulation, with practice in reading angles: base-line measurements. method of least squares and adjustments of triangulation systems; map projection; trigonometrical leveling.

117. Critical Description of Engineering Construction.—Details of methods and costs from personal inspection during progress of construction.

ELECTRICAL ENGINEERING

Professor Brooks, Assistant Professor Williams.

The Department of Electrical Engineering has a well-equipped laboratory containing a large variety of dynamos, motors, transformers, etc., furnishing facilities for tests upon the transmision and distribution of power. It has a particularly large and well selected cabinet of standard measuring and testing instruments. There are two photometers, and an assortment of the commercial varieties of electric lamps of all types. There is a storage battery of 60 cells, heating and welding apparatus, and an artificial transmission line for making reliable long distance transmission tests. The facilities for experimental engineering, both commercial and theoretical are excellent, and will be materially increased.

A full undergraduate course in Electrical Engineering is required for registration in graduate work.

COURSES FOR GRADUATES

101. Advanced Theory of Alternating Currents. — Discussion of the limitations of theory. Effect of minor errors of observation.

102. Dynamo Electric Machinery.— Standardization of armature windings, of design formulas, and of test methods. Study of leakage flux.

103. Alternating Current Machinery.— Transformers and their connections for single and polyphase working. Methods of compensation. The series and repulsion motor; operating efficiencies.

104. Transmission of Power.—Limiting conditions as re-

gards voltage, distance, charging current, and frequency. Types of machines. Experiments with artificial line.

105. Electric Light and Power Plants.—Economic limitations. Comparison of different designs. Determination of highest efficiency.

106. Electro-Metallurgy.—Experiments with the electric furnace. Refining of metals; recent storage batteries, and their possible improvement.

107. Electric Lighting. —Study of artistic illumination. Limitation of frequency for various types of lamps. Increased safety of wiring.

108. Electrical Engineering Research.—Problems to be assigned on consultation.

109. Electrical Design.—Standard practice. Discussion of improvements.

110. Telephone Engineering.—Standardization of apparatus. Switchboard design. Line testing. Methods for increasing efficiency and possible distance. Cables.

111. Telegraph Engineering.—Study of commercial conditions. Determination of best method or rapid machine-transmission. Simultaneous telegraphy and telephony. Wireless telegraphy in relation to ordinary telegraphy, and in regard to improvements.

MECHANICAL ENGINEERING

Professor Breckenridge, Assistant Professor Goodenough, Assistant Professor Leutwiler, Assistant Professor Randall.

The equipment available for experimental investigation in the Department of Mechanical Engineering is most complete along the following lines:

1. Boiler tests with various types of furnace and stokers.

2. The generation of power with engines of different types and at various steam pressures up to 275 lb.

3. The use of steam for heating from a central station, loss of pressure, and heat by transmission through long mains.

4. The generation, transmission and use of compressed air.

5. The generation of power by small gas or gasoline motors, including the testing of automobile vehicles.

6. Mechanical refrigeration.—There are three plants available for testing and examinination.

7. Locomotive road testing and train resistance tests.—For this work the department owns with the Illinois Central Railroad a fully equipped railway test car.

8. The measurement of power required to operate machine tools and woodworking machinery.—This includes tests relating to the performance of various tools and the comparison of different kinds of tool steel.

The construction of a new Steam Engineering Laboratory, for the equipment of which a generous appropriation has been made, will greatly increase the space and facilities of the department for experimentation.

A complete equipment will be added for experiments in the subject of heating and ventilation, as well as for the production of superheated steam.

Arrangements have been made with the management of the Peoria & Eastern Railway shops at Urbana for carrying on many tests and investigations on a commercial scale, not usually possible in a school laboratory, and much valuable aid is assured the department by the officers of this company. These shops are new, extensive and modern in all respects. There is required a full undergraduate course in Mechanical Engineering for entrancc upon graduate work.

COURSES FOR GRADUATES

101. Advanced Machine Design.—The work offered in machine design will be arranged to suit individual students. It covers a wide field and may include all forms of motors as well as usual and special machinery.

102. Graphics and Kinematics.—The application of graphical dynamics, especially to governors. A study of acceleration in mechanisms, using Coriolis' law as a basis.

103. Mill Engineering.— Transmission of power; design and installation of power plants.

104. Steam Engineering.—Critical study of superheating, jacketing, compounding; steam turbines: the generation of steam.

105. Experimental Engineering.—Tests of engines, boilers, air compressors, power plants, pumping plants, etc.

106. Thermodynamics.—Reading of advanced texts, as Parker's or Buckingham's. Critical study of cycles, both direct and reversed. Solution of numerous problems.

107. Pneumatics.—Air compression; transmission of air through pipes; theory and design of centrifugal fans and blowers; blowing engines.

108. Hydraulic Machinery.—Pumps and pumping engines; centrifugal and rotary pumps; hydraulic presses, punches, cranes, etc.; hydraulic elevators; hydraulic transmission.

109. Machinery and Manufacturing.—Shop construction and methods; cost-keeping systems; automatic machinery and interchangeable parts; adaptation of special machinery to the various industries.

110. Translation of Technical Engineering Literature.—Under this head is included the translation of engineering books and also of important articles appearing in Zeitschrift des Vereines Deutscher Ingeneur, Revue de Mècanique, etc.

111. Heat Engines and Gas Engineering.—The various heat engine cycles; temperature-entropy analysis applied to heat engines; engines with two or more fluids; general theory of the gas engine; gas producers; gaseous fuels.

112. Locomotive Engineering.—Study of the design and constructing of locomotives; counterbalancing; road tests of locomotives.

113. Mechanical Refrigeration.—Thermodynamic theory of refrigeration; properties of refrigerating fluids. Study of ice and refrigeration plants.

114. Motor Vehicles.—The various types of automobiles.

115. Indexing and Classification of Engineering Literature.

MECHANICS, THEORETICAL AND APPLIED

Professor Talbot.

The Laboratory of Applied Mechanics with its well-arranged building, numerous testing machines of various types for making tension, compression, cross-bending, and torsion tests of structural materials, the special facilities for testing paving brick, and its commodious hydraulic laboratory well fitted with tanks, piping, channels, pumps, motors and measuring devices, offers exceptional facilities for investigational work. New equipment is to be added, including a 500,000 lb. testing machine.

COURSES FOR GRADUATES

101. Analytical Mechanics.—Studies of advanced texts; comparisons of texts and methods and presentation for an elementary course.

102. Resistance of Materials.—Study of the properties of structural materials, of the methods of testing for these properties, and of the determination of internal stresses.

103. Hydraulics and Hydraulic Engineering. — Advanced work in hydraulics.

104. Laboratory of Applied Mechanics.—Investigational work either in the materials testing laboratory or in the hydraulic laboratory.

MUNICIPAL AND SANITARY ENGINEERING

Professor Talbot, Mr. Slocum

The University water works and the hydraulic laboratory, as well as the bacteriological and chemical laboratories, offer advantages to the student in water supply engineering and sewerage, and near-by cities give opportunities for a study of water filtration and sewage disposal plants.

COURSES FOR GRADUATES

101. Tanks, Standpipes and Reservoirs.— Design and methods of construction of these structures. Especial attention to the cause of failure of standpipes and to requirements for safe construction. Study of plans of existing structures and of methods of construction employed.

102. Sources and Requirements of Water Supply for a City and Removal of Impurities.—A study of the various sources of supply and of their development, of methods of filtration, and of the design and operation of filtered plants.

103. Water Works Management and Economics.—Water works records; revenue, operation, management, franchises and their relation to the public, with a study of existing plants.

104. Pumps and Pumping.—Types of pump; design, construction, operation, duty and efficiency; applicability of different types; duty trials and tests.

105. General Water Works Construction.—When practicable a discussion will be made of plans, methods, and construction of work with which the student has been connected.

106. Biological and Chemical Examination of Potable Water.—This will be given in connection with the departments of botany and chemistry.

107. Description of Water Supply Systems.—Critical discussion of water-works systems from personal observation made during construction and upon the operation of similar plants.

111. Sewage Purification.—A study of the processes and methods in use, of the results obtained, and of the requirements and needs of sewage disposal.

112. Sewage Disposal Works.—The design and methods of construction of various forms of purification plants and of their applicability and efficiency.

113. General Sewerage Design and Construction.—This usually involves the actual work of designing and participating in the work of construction of systems of sewers.

114. City Sanitation.—Methods and processes of garbage collection, reduction and disposal; sanitary restrictions and health measures.

115. Description of Sewerage Systems.—Critical examination and description from personal observations made during construction and upon the operation of sewerage systems.

118. Economic Aspect of Good Roads and Pavements.—An investigation of the value of road improvements.

119. Construction of Roads and Pavements.—Tests and requirements of meterials. Specifications. Comparison of cost, desirability and durability. Grades and location.

SOCIETIES AND CLUBS

CLUBS AUXILIARY TO COURSES OF STUDY

Agricultural Club

This club meets weekly. It is devoted to the discussion of topics of theoretical and practical interest to students of agriculture. All students connected with the University are eligible to membership.

Architects' Club

This club meets once in two weeks for the consideration of current topics of architectural interest and subjects connected with the study of architectural history. All students pursuing architectural studies are eligible to membership. This club is a member of the Architectural League of America, and contributes to its annual exhibition in the principal cities of the United States.

Biological Theory Club

This club meets on alternate Monday evenings throughout the college year for papers, addresses, and discussions on subjects in theoretical biology. Its membership is composed of instructors in biological subjects in the Colleges of Science and Agriculture.

Civil Engineering Club

This club meets the second and fourth Saturday evenings of each month for the reading and discussion of papers relating to civil engineering. All students pursuing the civil engineering course may become members.

The English Club

The English Club is composed of members of the Faculty, and of students who have done especially good work in English. The work of the club is confined to the study

of recent writers of fiction and of poetry. The membership is limited to thirty. Meetings are held on the second Monday of each month.

French Club

Le Cercle Francais includes students who have had at least one year's work in French. The club meets twice a month throughout the year. Its proceedings are conducted in French, the object being to supplement the work of the class room by the practical handling and understanding of the language.

Library Club

The instructors and students of the Library School have organized a Library Club. Any member of the staff of the University library, of the Champaign public library, or of the Urbana public library, or any student who is registered for the Library School may become an active member. Trustees of the three libraries before mentioned are considered honorary members. Any others interested in library progress may become associate members.

Meetings are held once in three weeks during the college year. The first and last meetings of the year are of a social nature. The intervening meetings are devoted to topics of literary or technical library interest.

Mathematical Club

The Mathematical Club is open for membership to the instructors and students of mathematics at the University. It meets once in two weeks to discuss questions of interest in pure and applied mathematics.

Mechanical and Electrical Engineering Society.

This club meets on the second and fourth Friday evenings of each month. All students pursuing mechanical and electrical engineering studies are eligible to membership. Papers relating to subjects of interest to members are presented and discussed at each meeting.

Musical Clubs

These include the Choral Society, Orchestra, Band, and Mandolin and Guitar, and two Glee Clubs.

The Natural History Society

This society is composed of instructors and students interested in the natural sciences. It conducts field excursions and exhibitions of objects of natural history, and provides occasional lectures on science subjects of general interest.

Political Science Club

This club is composed of the members of the corps of instruction in history, economics and law, and of such students of at least junior and senior standing as make a record for marked excellence in work in these departments. It meets once a month.

Zoological Club

The University Zoological Club is composed of advanced students and instructors in the zoological and physiological departments, together with such other biological instructors and advanced students as are interested in its subjects. Its sessions are devoted to the presentation and discussion of abstracts of recent biological literature and of the results of investigation by the members of the club. It meets weekly in Natural History Hall.

Literary Societies

The Adelphic and Philomathean societies for men, and the Alethenai for women, occupy large halls, which the members have appropriately furnished and decorated. Meetings are held Friday evenings throughout term time.

THE CHRISTIAN ASSOCIATIONS

Young Men's and Young Women's Christian Associations

The Young Men's and Young Women's Christian Associations have come to occupy a prominent place in the University life. Both are affiliated with the World's Stu-

dent Christian Federation, which is the largest student organization in existence.

Five hundred and fifteen men now belong to the Young Men's, and three hundred women to the Young Women's, Association. Each association employs for full time a general secretary.

The Association House furnishes free to all students, reading room, game room, library, parlors, piano, magazines and papers, correspondence tables and telephone—a college home.

Religious meetings for men are held on Sunday mornings; for women on Thursday afternoons; and for both men and women on Monday evenings. There are frequent meetings for the promotion of social intercourse and good fellowship.

Courses in systematic Bible study and in modern missions are offered. During the year four hundred and twenty-nine men and two hundred women have enrolled in these courses. A most helpful feature of the work is that in the interest of new students at the opening of the school year. Desirable rooms and boarding places are found and posted for reference as the Association House. Representatives of the Associations meet the trains, assist students in finding satisfactory locations, and endeavor in every way to make them feel at home. The employment bureau helps to find work.

A copy of the Students' Hand-Book, containing a map of the cities, and giving information about Champaign and Urbana, the University, and the various college organizations and activities, will be sent free to prospective students.

For further information address the General Secretary of either Association, Champaign.

EXPENSES

BOARD

The University does not furnish board, but there are a large number of suitable places within easy walking distance of the University or readily accessible by electric railway where students can find table board at from $3.00 to $3.50 per week each, and rooms (suitable for two) at about $36.00 to $54.00 for a semester of 18 weeks.

The Young Men's and Young Woman's Christian Associations aid new students in procuring rooms and boarding places.

FEES

The fees for members of the Graduate School are the same as for undergraduate students of the Colleges of Literature and Arts, Agriculture, and Engineering as follows:

Matriculation, payable upon entrance	$10.00
Diploma, payable before degree is awarded	5.00
Incidental, each semester	12.00
Laboratory, actual expenses, deposits	50c to 10.00

LIST OF STUDENTS

GRADUATE SCHOOL

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

*Crocker, William, A. M., 1903, *DeKalb*, Botany.
Day, Edna Daisy, M. S., (*Univ. of Mich.*), 1897, *Urbana*, Botany.
Dewey, James Ansel, M. S., 1898, *Urbana*, Bacteriology.
Gleason, Henry Allen, B. S., 1901, *Champaign*, Botany.
Heuse, Edward Otto, B. S. (*Hanover, Coll.*), 1900, *Madison, Ind.*, Chemistry.
Latzer, Jennie Mary, M. S., 1900, *Highland*, Botany.
Matson, George Charleton, A. M., (*Cornell Univ.*), 1903, *Champaign*, Geology.
Miller, John Ezra, A. M., 1902, *Urbana*, Latin.
Pillsbury, Bertha Marion, A. M., (*Radcliffe College*), 1899, English.
Ponzer, Ernest William, M. S., 1903, *Champaign*, Mathematics.
Reeves, George I., A. B., 1902, *Wauponsee*, Zoology.
*Ross, Luther Sherman, M. S., 1900, *Des Moines, Ia.*, Zoology.
Sakagami, Yasuzo, M. L., (*Univ. of Minn.*), 1899, *Wakagamaken, Japan*, Political Science.
Sammis, John Langley, M. S. 1899, *Champaign*, Chemistry.
Schulz, William Frederick, E. E., 1900, *Urbana*, Physics.
Zartman, Lester William, A. B., 1903, *Grant Park*, Economics.

CANDIDATES FOR THE MASTER'S DEGREE

Anderson, Mary, A. B., 1903, *Macon*, Mathematics.
Barrett, James Theophilus, A B., 1903, *Urbana*. Botany.
Black, Alice Mary, A. B., 1900, *Champaign*, Latin.
*Bond, Anna Louise, A. B., 1903, *Mt. Vernon*, English.
*Booker, Lucile Alice, A. B., 1899, *Stillwater, Minn.*, English.
Briscoe, Charley Francis, A. B., (*Indiana State Univ.*), 1899, *Urbana*, Botany.
*Bullock, Jessie Jane, A. B., 1900, *Champaign*, Mathematics.
*Church, Walter Samuel, B. S., 1900, *Chicago*, Architecture.
*Clark, Mary Edith, A. B., 1899, *Sheldon*, Philosophy.

*In absentia. See page 29.

Clarke, Samuel C., B. S., (*Univ. of Chicago*), 1900, *Urbana*, Chemistry.

*Clarke, Edwin Besancon, B. S., 1891, *Chicago*, Architecture.

‡Collis, Frank Bernard, B. S., 1902, *Norwich, Conn.*, Mechanical Engineering.

Crosthwait, George Ashley, B. S., 1903, *Moscow, Idaho*, Agronomy.

Crane, Fred Randall, B. S., (*Mich, Agr'l Coll.*), 1899, *Urbana*, Agronomy.

Dickerson, Oliver Morton, A. B. 1903, *West Liberty*, History.

Dillon, Gertrude Sempill, A. B. 1901, *Sheldon*, German.

East, Edward Murray, B. S., 1901, *Champaign*, Agronomy.

Emmett, Arthur Donaldson, B. S., 1901, *Urbana*, Chemistry.

Falkenberg, Fred Peter, A. B., 1902, *Chicago*, English.

Fox, Harry Bert, B. S., 1900, *Urbana*, Geology.

Franklin, Lois Gertrude, A. B., 1903, *Dwight*, History.

Fritter, Enoch Abraham, A. M., (*Findlay Coll.*) 1898, *Normal*, English.

*Fucik, Edward James, B. S., 1901, *Chicago*, Civil Engineering.

*Gallaher, Thomas Theron, A. B., 1902, *Byron*, Philosophy.

Garlough, Carl D, A. M., (*Hillsdale, Coll.*), 1900, *Stanford*, Mathematics.

Gilkerson, Frances Emeline, A. B., 1903, *Urbana*, German.

*Greenman. Edwin Gardner, Jr., B. S., 1902, *Champaign*, Mechanical Engineering.

*Grimes, George Lyman, B. S., 1897, *Kewanee*, Mechanical Engineering.

Harris, Thomas Luther, A. B., 1902, *Modesto*, Economics.

Hayhurst, Emery Roe, A. B., 1903, *Maywood*, Physiology.

*Heath, Lawrence Seymour, A. B. 1901, *Edinburg*, Latin.

*Hicks, Byron Wallace, B. S., 1901, *Warren*, Civil Engineering.

*Higgins, Francis Whitson, B. S., 1902, *Niagara Falls, N. Y.* Chemistry.

Hoff, Edna DuBois, A. B., 1903, *Chicago Heights*, Chemistry.

*Hoppin, Charles Albert, B. S., 1901, *Milwaukee, Wis.*, Mechanical Engineering.

Horner, Harlan Hoyt, A. B., 1901, *Urbana*, English.

Hughes, Clarence Wilbert, A. B., 1900, *Urbana*, History.

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‡Died, November 5, 1903.

Ingels, Bert Dee, B. S., (*DePauw Univ.*), 1903, *Greencastle, Ind.*, Chemistry.

*Ireland, Washington Parker, B. S., 1903, *Chicago*, Civil Engineering.

*Johnson, Frederick Dawson, B. S., 1903, *Alton*, Mechanical Engineering.

*Johnson, Fred Vollentine, B. S. 1902, *Harvey*, Mechanical Engineering.

Jones, Warren, A. B., 1902, *Aurora*, Eduation.

Kelley, Frances Emily, A. B., 1901, *St. David*, German.

*Kofoid, Reuben Nelson, A. B., 1902, *Buffalo, N. Y.*, Chemistry.

Lafferty, Guy Clifford, A. B., (*Monmouth, Coll.*), 1903, *Alexis*, Economics.

Larson, Lawrence Fred, A. B. 1903, *Galva*, Economics.

*Layton, Katherine Alberta, A. B., 1901, *Canton*, German.

Lytle, Ernest Barnes, B. S., 1901, *Urbana*, Mathematics.

*McConnell, Ernest, B. S., 1894, *Denver, Colo.*, Architecture.

*McLane, John Wallace, B. S., 1901, *Washington, D. C.*, Agronomy.

Malcolm, Charles Wesley, B. S., 1902, *Roseville*, Civil Engineering.

*Martin, Albert Carey, B. S., 1902, *LaSalle*, Architecture.

Matthews, Robert Clayton, B. S., 1902, *Champaign*, Mechanical Engineering.

*Mayall, Edwin Lyman, B. S., 1900, *Peoria*, Mechanical Engineering.

Miller, Harry Crawford, A. B. (*Austin, Coll.*), 1893, *Nokomis*, Education.

Moor, Rev. George Caleb, Ph. D., (*Ewing, Coll.*), 1899, *Champaign*, English.

*O'Hair, Elizabeth Edna, A. B., 1901, *Laurel, Ind.*, Latin.

Parker, Lawrence Gilbert, B. S., 1902, *Toluca*, Civil Engineering.

*Parr, Robert William, A. B., 1903, *Pontiac*, Economics.

Ponzer, Ernest William, B. S., 1900, *Champaign*, Mathematics.

*Radcliffe, William Hickman, B. S., 1901, *Chicago*, Civil Engineering.

Randall, Dwight T. B. S., 1897, *Urbana*, Mechanical Engineering.

*Richard, Frederick William, B. S., 1891, *Carterville,* Mechanical Engineering.

Rolfe, Martha Deette, B. S., 1900. *Champaign,* Zoology.

Rolfe, Mary Annette, A. B., 1902, *Champaign,* Zoology.

*Sawyer, Geogre Loyal, B. S., 1903, *Chicago,* Municipal and Sanitary Engineering.

*Scudder, Harry Disbro, B. S., 1902, *Chicago,* Horticulture.

*Skinner, Elgie Ray, B. S., 1903, *Chicago,* Mechanical Engineering.

Slocum, Roy Harley, B. S., 1900, *Urbana,* Municipal and Sanitary Engineering.

*Smith, Bruce, A. B., 1901, *Newman,* English.

*Smith, Florence Mary, A. B., 1899, *Urbana,* English.

Smith, Fred John, A. B., (*Iowa Wesleyan University*), 1899, *San Jose,* German.

*Smith, George Russell, B. S., 1900, *Urbana,* Mechanical Engineering.

*Smith, Percy Almerin, B. S., 1901, *Hiroshima, Japan,* Mathematics and Physics.

*Soverhill, Harvey Allen, B. S., 1900, *Beloit, Wis.,* Mechanical Engineering.

*Sperling, Godfrey, B. S., 1895, *Boise, Idaho,* Civil Engineering.

*Stine, John Carl, A. B., 1903, *Assumption,* Education.

*Strehlow, Oscar Emil, B. S., 1895, *Tuscaloosa, Ala.,* Civil Engineering.

*Sussex, James Wolfe, B. S., 1903, *Abingdon,* Civil Engineering.

*Swanberg, Floyd Ludwig, B. S., 1902, *Danville,* Mechanical Engineering.

*Sweeney, Don, B. S., 1896, *Galesburg,* Mechanical Engineering.

Taylor, Helen Mary, A. B., 1902, *Bloomington,* English.

*Terry, Charles Dutton, B. S., 1897, *Kewanee,* Mechanical Engineering.

*Tower, Willis Eugene, B. S., 1894, *Chicago,* Physics.

*Tull, Effie May, A. B., 1901, *Farmer City,* Latin.

Waterbury, Leslie Abram, B. S., 1902, *Urbana,* Civil Engineering.

Webber, Roy Irvin, B. S., (*Purdue Univ.*), 1899, *Urbana,* Civil Engineering.

Wells, Miriam Ursula, A. B., 1903, *Malden,* Zoology.

Western, Irving Mark, A. B., 1902, *Dundee,* Rhetoric.

*Whitehouse, Edith Ursula, A. B., 1902, *Canton*, Latin.
*Whitmeyer, Mark Halbert B. S., 1899, *Danville*, Architecture.
Whitsit, Hammond William, B. S., 1903, *Urbana*, Architecture.
*Wilcox, Maurice Meacham, B. S., 1899, *Kentwood, La.*, Civil Engineering.
Williams, Winifred Sue, A. B., 1901, *Urbana*, German.
Willis, Clifford, B. S., 1900, *Urbana*, Agronomy.
Wilson, Joseph Wade, B. S., 1903, *Chicago*, Architecture.
*Wright, Sidney Walter, A. B., 1901, *Mechanicsburgh*, History.
*Wood, Harvey Edgerton, A. B., 1900, *Joliet*, Economics.
Young, Sadie, B. S., (*Univ. of Fla.*), 1902, *Lake City, Fla.*, English.

NOT CANDIDATES FOR A DEGREE

Calhoun, Henrietta Anne, A. M., 1903, *Champaign*, Physiology.
Fox, Fred Gates, A. M., 1903, *Urbana*, English.
Lefler, Emma Grace, B. L. S., 1903, *Pontiac*, English.
Lloyd, John William, M. S. A., (*Cornell Univ.*), 1903, *Champaign*, Botany.
Zangerle, Arthur Norman, B. S., 1903, *Chicago*, Chemistry.

SUMMARY OF STUDENTS—1903-1904

	Men.	*Women.*	*Total.*
GRADUATE SCHOOL	94	26	120
UNDER GRADUATE COLLEGES—			
Seniors	170	104	274
Juniors	186	72	258
Sophomores	388	87	375
Freshmen	439	134	573
Specials	196	106	302
	1279	503	1782
SPECIALS IN AGRICULTURE	133	1	134
SPECIALS IN HOUSEHOLD SCIENCE		14	14
SUMMER TERM	137	92	229
COLLEGE OF LAW—			
Third year	36		36
Second year	27		27
First year	52		52
Specials	27		27
	142		142
COLLEGE OF MEDICINE—			
Seniors	227	18	245
Juniors	178	12	190
Sophomores	132	11	143
Freshmen	85	9	94
Unclassified	19	3	22
	641	53	694
COLLEGE OF DENTISTRY—			
Seniors	56	3	59
Juniors	64	1	65
Freshmen	39		39
	159	4	163
SCHOOL OF PHARMACY—			
Seniors	68		68
Juniors	116	1	117
	184	1	185
ACADEMY	189	68	257
	2958	762	3720
Deduct counted twice	80	44	124
Total in University	2878	718	3596

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